Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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Example of Maintenance That Anticipates Trouble and Removes Its Source Before the Trouble Can Develop.

The first view shows one of the guy wires of a steel stack crossing over and dangerously near the distribution lines on the other side of the alley; the stack was also insufficiently guyed. The second view shows the stack guyed to three poles especially set for the purpose, the tall one removing the hazard from the guy over the live line. By making these changes the central-station company has practically removed the possibility of trouble to its lines from failure of the stack or any of its guys.

Why Electric Service Must Be Maintained

Electric Power Supply an Essential Element in Winning the War—Maintenance of Generating and Distributing Equipment Necessary for Reliable and Economical Service

By F. H. BERNHARD

ECONOMY is one of the most important needs of these strenuous war times. Loyalty to the splendid cause that we uphold requires that all wastes be eliminated and that ordinary expenditures and consumption be limited to those necessities upon which the welfare of the nation depends. In this way only can we release for prosecuting the titanic struggle into which we have been drawn the tremendous resources that are needed to insure its early and successful termination.

The practice of economy is taking hold of the American people in general and especially so of business men. Increasing costs of materials and labor, together with uncertainties in the business outlook compel special consideration of all possible economies before the prices of products be radically increased and output thereby restricted. In the public utility field this is particularly true, since rates cannot be raised indiscriminately without the consent of the regulatory commissions, and these bodies are reluctant to grant such increases until it is clearly shown that the utmost economy is being exercised in the operation of the utility.

Managers of electric utilities are fully alive to the need for unusual operating economy and also for economy in improvements, such as extensions and desirable replacements. These betterments are now being restricted to the most definitely essential, both because of high costs and difficulties in raising the necessary capital. Correspondence and personal inquiry among managers of typical central stations conducted by editors of the ELECTRICAL REVIEW as to

the extent of the usual spring construction work have shown that this will be restricted this year almost entirely to only such work as is already under way or for which the financing has already been done and orders placed. Projects that would doubtless have been undertaken under more favorable financial and cost conditions are being indefinitely postponed. Line extensions are being generally limited to those which the prospective consumers are financing in whole or in part. In some places even the replacement of practically wornout equipment is not contemplated this year, the managements being seized with what amounts virtually to panic.

That such an extreme policy is not only short-sighted, but actually dangerous, will be shown in the following. The nation demands economy but it does

Result of Failure to Maintain a Boiler Properly in an Electric Light Plant.

A boiler in a small central station, resenting lack of suitable attention, "let go" and scattered itself and most of the plant over the surrounding premises. That the destruction was not still more serious was almost a miracle.

not want that false economy that comes from parsimony. When economy is carried to the point where the saving effected is less than the cost of overcoming the harm produced, it ceases to be economy. The primary object of public utilities is to serve the public. If through some misdirected savings the service is rendered grossly unreliable and inadequate, the supposed economy becomes a myth. In recent months the railroads have been accused of intentionally failing to maintain their properties in efficient condition. This charge may be not at all true, but the public has been quick to accept it as one of the causes for the serious traffic tieup of the last few months and in some quarters it is being urged as a reason for permanent government ownership of the railroads. At any rate, the tieup has lowered the prestige of the railroads by exposing their inability to render adequate service when their aid was depended on in a grave national crisis.

In times now fortunately almost past, it was customary for a utility whose franchise was approaching expiration to let the property and the service it was rendering run down to a very low state of efficiency. There may have been some reasons for this in view of the uncertainties of dealing with city councils, but in general it was unquestionably a sadly mistaken policy. It stirred up ill will against the utility corporation on the part of the general public, it gave an opportunity for professional agitators to bring utility questions into politics, and it undoubtedly was largely responsible for the imposition of onerous requirements in the franchises when renewed. In these times of commission regulation there is little or no excuse for following such a suicidal policy. In fact, those commissions that have established service standards and service inspection will not tolerate a deterioration of the service.

Public Interest Demands That Utilities Be Maintained at Maximum Efficiency.

President Wilson only the other day voiced the growing sentiment of the American public when he said: "It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view." Secretary of the Treasury McAdoo, recognizing the importance of utility service to the nation, said, "Our public service utilities are closely connected with and are an essential part of our preparations for and successful prosecution of the war." The fact is that public utility service was never so necessary to the nation's welfare as at present. Increased power demands by the many industries making the nation's munitions of war are being met more economically, expeditiously and reliably by central-station systems than by enlargement of old, or erection of new, isolated power houses. Electric light, power and signaling services of dependable character are being provided for scores of army camps, training grounds and embarkation ports. Necessary protective lighting is being furnished for military and war-supply establishments. Proper housing of thousands of employes of munition and shipbuilding plants calls for electric light service and electric railways for carrying these employes quickly between their abodes and places of employment. In view of these facts, it is no wonder that the government authorities have recognized the necessity of maintaining unimpaired, efficient utility service.

The urgent need for general economy also emphasizes the economic character of such service. The necessity for conserving coal enhances the value of the large, efficient central-station generating plant and makes it uneconomical to operate small, inefficient power plants. The brief career of the "jitney" bus, which aroused so much interest a few years ago, has convinced the public that urban transportation is provided most economically by electric traction systems. It is evident that the electric utilities in general are better understood by the public and the importance of their service is more widely appreciated than ever before. Indeed, the public as a whole agrees with the President and the Secretary of the Treasury that it is better to raise the rates where necessary than to permit the utilities to suffer through insufficient resources, which means inadequate maintenance accompanied by impaired efficiency and dependability of service.

Enough has been said in the foregoing to show that the public is relying more than ever on continuous, high-grade electric service, which has become indispensable to the nation as a whole. Moreover, it is willing to bear the present additional cost of providing this service rather than put up with possible interruptions and lowered efficiency. Clearly there is no excuse left for a central-station manager failing to maintain his property in top-notch condition so that the community he serves and the country at large may not find his service lacking, as was that of the railroads in January, just when it was needed most.

In the large central-station system proper consideration is usually given to maintenance and depreciation, but in the small plant these matters are more

likely to be overlooked, especially at a time like this when conditions are somewhat unsettled. However, even in some fairly large companies there is a tendency to skimp maintenance this year as much as possible, to an extent, in fact, that is likely to have serious effects on efficiency.

For many years public utility engineers and accountants have discussed the subjects of maintenance, depreciation and the related topics of obsolescence, reserve funds, etc. Considerable differences of opinion have arisen concerning the details of these matters, but in general there is agreement along the following lines. The property of a utility company, aside from its land, depreciates or deteriorates in value and efficiency with wear and tear and also with age. Part of this deterioration can be overcome by proper maintenance; as a rule, this consists in making such minor repairs or replacements of parts as will maintain the machine, apparatus, or other equipment considered in the highest possible state of efficiency. For instance, an exciter has its brushes replaced, commutator trued up, armature blown out, etc., at various intervals; the more thorough the attention given to the machine, the more perfect its maintenance, the more efficiently and reliably it will operate and the longer will be its useful life. Maintenance is evidently closely associated with operation and the cost of maintenance should form a part of regular operating charges.

In spite of careful upkeep the deterioration of part of the plant equipment is likely to continue so that at a certain point it will become cheaper to replace the machine or apparatus bodily than to repair it to anything like original efficiency. For instance, in case of a boiler, a gradual deterioration of the strength of the tubes, stays, drums, etc., will take place despite regular cleaning, inside and out, so its safety and operating capacity becomes decidedly impaired, making complete replacement desirable. Such deterioration, eventually terminating the useful life of an apparatus, is technically called depreciation. The cost of making a complete replacement of the apparatus is usually met from a special fund known as a depreciation fund; certain sums are set apart each year out of earnings so that the total sum, with interest, at the end of the estimated useful life of the apparatus permits replacing it without drawing on operating expenses or new capital.

It should be noted that in the case of some equipment, like pole lines, it is possible by proper maintenance to extend the useful life indefinitely, for by replacing a decayed pole or crossarm here and there as it becomes worn out, likewise by replacing fractured insulators and broken or weakened wires when needed, the line may be kept in splendid condition for an extremely long time. As an almost invariable rule, perfect maintenance improves the operating efficiency, extends the useful life and increases the safety of equipment and its immunity from damage by abnormal strains.

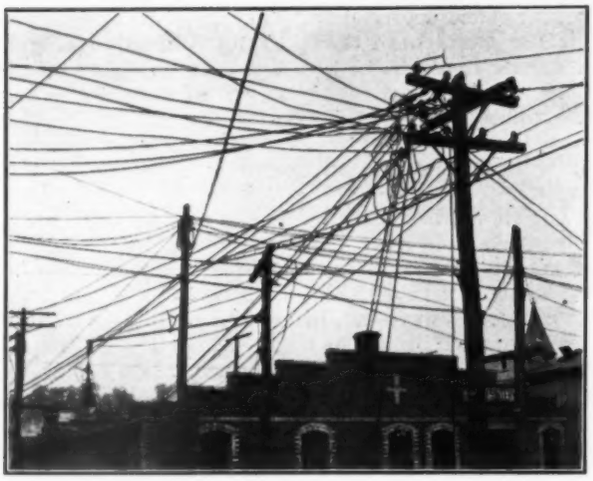
Proper Maintenance Insures Safety.

It is necessary to again remind the central-station and other electric utility managers that their service was never before so fully appreciated and depended on as at present. Not only the public at large, but the Government recognizes electric service as peculiarly essential at this critical time. Furthermore, even the former most bitter opponents of central-station service, the owners of isolated plants, are in many cases showing an eagerness to be served from a central supply, and those endeavoring to solve the coal shortage are pointing out how fuel conservation will be materially aided by changing over the inefficient isolated plants to central-station service.

Clearly the requirement of the hour is not decreasing maintenance to a minimum, but increasing it to the greatest reasonable extent. Let us consider for a moment what an absurdly ridiculous policy minimum

Typical Cases of Poles Weakened at the Ground Level and in Urgent Need of Being Replaced to Prevent Failure of the Line.

Decay of poles almost invariably occurs chiefly at the ground line. In the three cases shown observation of ground-line conditions was obstructed by large stones, a heap of rubbish and tall grass in the order named. Removal of the obstructions to permit taking the photographs disclosed decay so far advanced that the poles were likely to fail from excessive strains of a bad storm.



Poorly Maintained Circuits Leaving a Power Plant.

Accidents to linemen and to pedestrians, as well as crosses and other interruptions of service, are likely to occur from such promiscuously arranged and poorly kept circuits. Clamor for ridding the streets of overhead circuits often also results from such conditions.

maintenance is. Suppose the plant is allowed to run down without attention to boiler-scale removal and soot cleaning, repair of furnace and setting cracks, replacing of broken gauge glasses, etc. Efficiency and operating economy will, of course, suffer first, but more important yet, conditions will be made ripe for positively disastrous results. If allowed to continue indefinitely, the end of the plant's career may suddenly come in a violent boiler explosion such as that which wrecked an electric plant and created the havoc shown in one of the accompanying illustrations. Here was the tragic end of false economy. An ounce of prevention is indeed worth a pound, sometimes even a ton, of cure.

It is scarcely necessary to call attention to countless other, sometimes less violent, results of a policy of minimum maintenance. Failure to replace a pole that is seriously decayed at the ground line may result during a terrific storm in causing failure of a considerable section of an overhead line. Even a steel tower line that is not inspected, painted and otherwise maintained properly may fail because the storm strain was too great for a corroded member in one of the towers, as is shown in another illustration.

It was formerly the custom to pass the responsibility for damage by lightning, floods, wind and sleet storms, explosions, and the like, to an inscrutable Providence. Knowledge of construction and maintenance has advanced so far, however, that such destructive agencies, protection against which was not understood in the early stages of the art, can now be rendered quite harmless. In many cases damage by such causes is only a reflection on the ignorance, negligence or parsimony of the management.

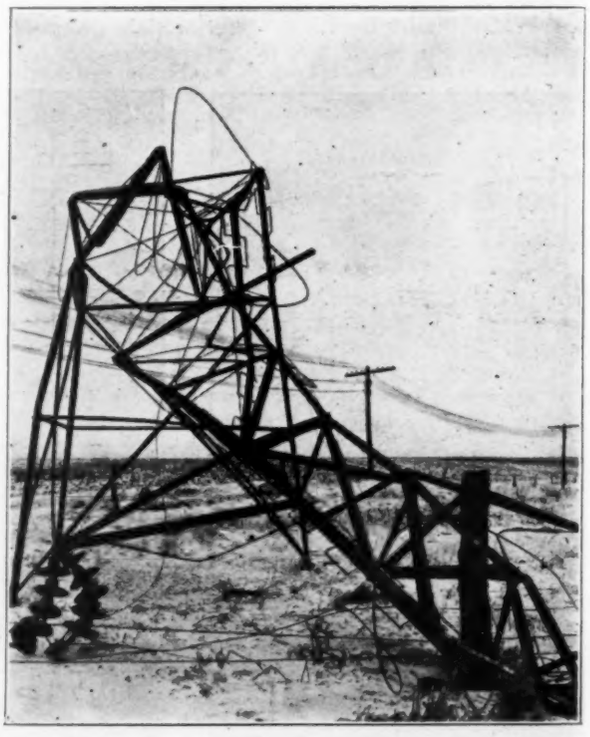
A large number of men have been called into the nation's active service and their places have been taken by less experienced employes. These new men are in many cases unfamiliar with the special needs of the equipment placed in their charge and often, indeed, do not understand its construction. This condition places an added responsibility on the management to see that the equipment is kept in first-class working condition and that interruptions to service from inadequate inspection and maintenance be guarded against.

Casual glance along a distribution circuit in an alley may fail to disclose any weakness to an inexperienced lineman or inspector. Only too often, in unpaved alleys after a long winter especially, the bases of the poles will be covered by piles of ashes or other rubbish and the decay at the ground line hidden unless the rubbish, stones or grass are removed to expose the weak parts.

Countless other instances might be cited of the exceptional present need for high-class maintenance. In the case of progressive central-station companies thorough inspection and maintenance anticipate troubles and remove their probable source before they develop. Two of the accompanying views show a case of this kind. The cost of making the changes illustrated was small compared with the troubles that would have resulted from collapse of the stack onto the lines.

Not only ordinary maintenance but even complete rehabilitation of equipment is justified by prevailing conditions in many cases. Extraordinary loads and abnormal operating conditions are now frequently imposed on apparatus. The cost of such complete overhaul or change is well warranted by the increased capacity and reliability obtained. In many cases necessity has stimulated the development of less expensive methods, as is described in the following article.

Electric service is now on trial. The demand for it is greater than ever. If it is met by safety and reliability, the demand will not only continue but greatly increase after the return of normal times. If safety is not given proper consideration, the prestige of the central station will suffer. Safety and continuity of service can readily be promoted by greater attention to maintenance and reasonable expenditures to this end are not only warranted but expected by no less an authority than the President of our country.



Havoc Created on Overloaded Lines by a Severe Storm.

A tall steel tower on a high-tension transmission line collapsed during a storm because a weak structural section had not been strengthened. Wires in nearby telephone line were displaced and are in need of readjustment.

A Standardized Method of Unit Construction for Central Stations

Method of Sectionalized Construction Employed by the Commonwealth Edison Company that Expedites Construction and Reduces Costs, Simplifies Operating, Increases Safety and Improves Station Layout

THE past year has been rather a difficult one for most central-station companies. It has been difficult to obtain fuel for normal needs, and the demand has increased. Loads have increased faster than capacity has been obtainable, while there is a continued demand for central-station energy above the past normal rate of growth. Costs of fuel and materials have gone up, while the quantity and quality of labor has gone down until today both men and materials are at high premium. These conditions have combined to make it difficult to meet the demands of customers, while the inflated prices of material and growth of the short-time transitory loads that are but for the duration of the war have still further created the necessity of economy in construction and other expenditures.

The higher expenses and larger margin between gross revenue and net income have demanded attention to the smallest detail of expense in the endeavor to save, eliminate extravagances, simplify, and conserve men, materials and apparatus. The use of voltage regulators instead of installing increased cross-section of copper, apart from improving the standard of service and being the correct solution to a comparatively simple problem, is a very economical measure in a good many cases at this time, and thus may be considered as one of those measures that by spending a little saves considerable in investment and increases income, since energy consumed is directly affected by voltage regulation. The installation of feeder regulators is an item of construction, and here, too, every effort should be made to reduce initial cost. The subject, therefore, of installing induction regulators cheaply and quickly is pertinent at this time and should be of general interest.

The Commonwealth Edison Company has employed for several years a form of construction possessing many points of interest both from the construction, economic and operating aspects. The method was not primarily adopted as a war measure,

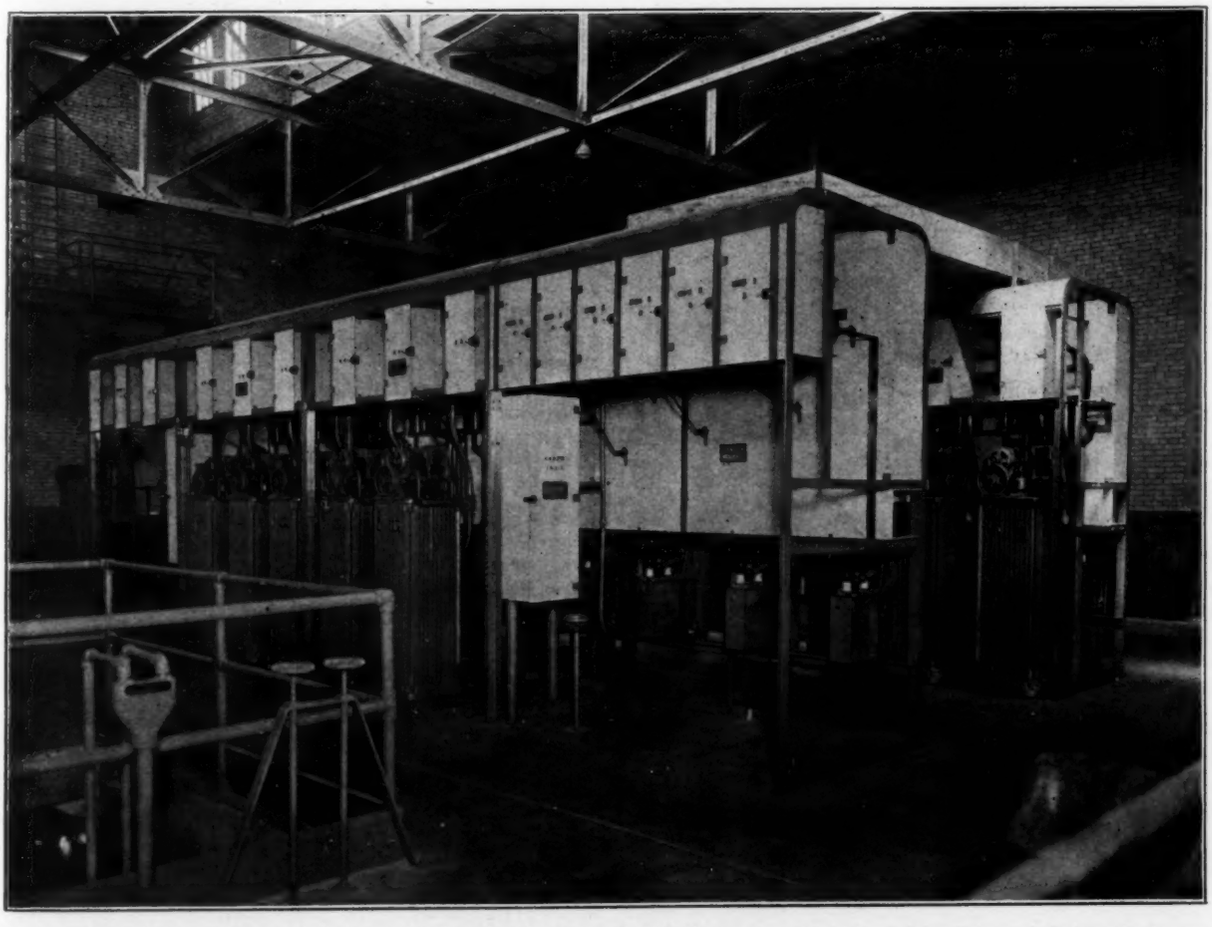


Fig. 1.—General Arrangement of Feeder Cabinets, Showing Location of Apparatus, Method of Mounting and Safety Enclosure.

but nevertheless is extremely well suited as such because of its simplicity, low unit cost and the manner in which it enables certain difficulties of the labor situation to be overcome. This company has adopted what might be called the inclosed unit method of installing its 4000/2300 feeders. Each unit is complete in itself and comprises everything in any way concerned with a three-phase four-wire circuit and its regulating apparatus except that mounted on the switchboard. The method of inclosing the equipment and the way in which the unit is constructed for low cost are both interesting.

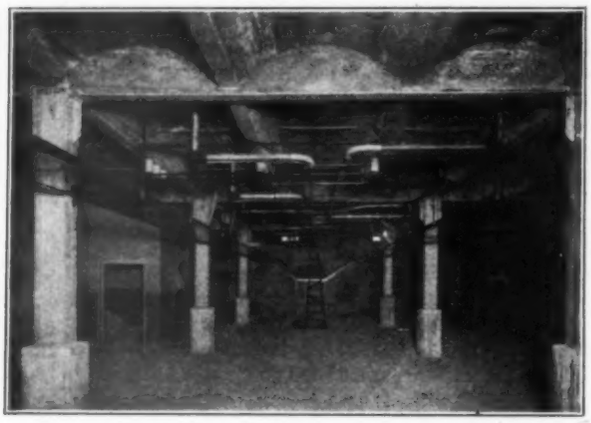


Fig. 2.—View of Basement Beneath Feeder Cabinets, Showing Control Wiring Enclosed in Conduit and Four-Conductor Cable Where it Passes Through Ceiling and Rests in Cable Runway.

The complete feeder installation comprising a unit usually consists of six single-phase, 115-volt direct-current solenoid operated oil circuit-breakers and six disconnect switches, three to each of the two main busbars, three single-phase induction regulators and transfer disconnect switches between them and their feeders, a current and potential transformer per phase, one line drop compensator in the neutral, and one secondary relay per phase. Apart from this equipment, which is completely inclosed by the unit frame, there are the two station buses and an auxiliary or transfer bus carried upon and enclosed by the unit frame. A general idea of the appearance of a number of these units is obtained from Fig. 1.

Details of Unit Construction.

Each unit comprises the inclosing frame, which is made up of angle irons bolted together. Upon this frame are mounted the cabinets used to partition and isolate the high-voltage phases and disconnect switch cabinets, which are made of asbestos board about ¼ inch thick bolted together. Upon the steel frames are mounted all apparatus except the regulators and switchboard equipment, which, as seen in Fig. 1, are located in their allotted places upon floor or switchboard. All phases are protected from each other by barriers of asbestos, as seen.

From Fig. 3 a better idea of the general layout can be obtained. At one side of the unit are hung the oil circuit-breakers connecting the regulators or circuits to buses. Immediately above the breakers are the disconnect switches connecting above with the two main station 4000-volt busbars which run in vertical plane through the unit in their asbestos cabinets. Above these buses are installed the transformer bus. At the other side of the units, in their respective locations, stand the regulators, and above, mounted upon them, are the secondary or reversing relays. Above these, mounted upon the iron frame, are the disconnect switches for cutting in or out the regulators with their cabinets. These transfer switches are of double pole and double blade type so as to transfer the circuit from its regulators to a spare circuit equipment or to regulators of another circuit through the transfer bus. A disconnective switch has been added to ground the circuit cable. Underneath the circuit-breakers a terminal board is hung, to which all meter and motor leads go from transformers, the solenoid operated oil switch and regulator motor, thence to the switchboard. In the case of current transformer secondaries, they pass through link switches before passing to switchboard. In this way meters may be readily checked or trouble located, which is the purpose of this terminal board.

Safety Feature Prominent Factor of Design.

The asbestos cabinets containing the disconnects to the oil switches are so arranged with interlocking devices that the disconnects of either bus may be operated at a time, but not both. Both cabinets may, however, be locked closed, as is done in some cases when men are working on equipment or a circuit. As both sets of disconnects cannot be operated at once, there is little opportunity for mistakes to occur. All units and individual phase sections are stenciled conspicuously inside and outside as to circuit number and phase letter. All live parts are inclosed and each phase is protected from the others. All equipment such as secondary relay and potential transformers are so placed as to be accessible without endangering the operator to danger in making replacements or inspecting. All parts are in fact amply protected, yet readily accessible.

From Fig. 1 it will be seen that extensions are easily made, since it is merely a matter of adding additional units to those already installed. The respective rows of units, as shown, are so spaced that there is ample room to move a regulator out of its position and move another in its place.

Making Up and Installing the Units.

The angle-iron frames are made up in the company's shops, where facilities exist for economical and quick work. Here, too, are made the asbestos cabinets and switchboards. The frames are erected and the asbestos cabinets mounted upon them in the shop, as are in some cases the marble slabs for the disconnect switches. When a station is ready to receive the unit it is shipped out already made up, usually on an electric truck. Just how much apparatus is actually mounted in place upon the frame in the shop is really a matter of convenience, and depends largely upon the weather, the distance from shop to substation and the facilities for moving the feeder unit from truck to its location in the station. However, the cabinets and disconnects are usually installed in the shop, the copper buses, breakers, and instrument transformers being mounted in place in the station. It is to be noted that the 4000-volt copper buses which are enclosed in asbestos compartments are bare, but the exposed copper connections are insulated as a safety measure.

Once in the substation, the work of getting the unit into service is usually rapid. The frame is bolted down to expansion bolts, probably already installed. The outgoing cable is pulled up through the floor while the various pieces of apparatus are mounted upon the frame in locations ready to receive it. Control wiring

is pulled through conduit and connected to the terminal board while the main and auxiliary buses are connected up to those of adjacent units. The regulators are run into place and connected up to the lugs of the disconnects already mounted above them. The whole work of mounting the apparatus is simple, and requires really little more than the use of screwdriver, wrench and solder pot. All apparatus is installed upon the same floor, the only exception being the outgoing feeder and control wiring to switchboard, both of which pass through the floor, the one a lead-covered four-conductor cable which passes to the cable runway in the basement, while the control wires pass in conduit to the switchboard. Four holes altogether are required in the floor for each section or circuit unit.

The method of running the underground cables from their regulators to the manholes is particularly interesting. As seen in Fig. 2, the cables, instead of being laid upon the basement floor and then covered with cement, as is the common practice, are carried upon a sheet-iron cable runway carried on supports hung from the ceiling. This method is the simplest and cheap—the cables, while protected from external damage by cement wrapping, are readily get-at-able for change or repair. Moreover, being exposed to the air, ventilation is ample.

Economic Advantages of Unit Construction.

The above mentioned method of installing feeder control apparatus has a large number of advantages, with few, if any, disadvantages, as to substation design, low unit cost, flexibility and operating features. Having all apparatus on the same floor and utilizing head room instead of floor space enables high kilowatt capacity for given floor space and correspondingly low expense for substation construction. For quick work the arrangement is almost ideal. The frames may be erected and made ready before the substation is ready to receive them, thus reducing delays. Moreover, the mounting of the individual pieces of equipment is so simple that once the substation permits the work can be carried on to rapid completion. Since the work required for making up the frame is done in the shops, the unit cost is low. As the frame and apparatus for each feeder unit is the same, each feeder installation is a duplication of the other, thus reducing the amount of work performed by all departments and enabling sudden requirements to be met quickly with a minimum of effort, since the work assumes the aspect of routine. The elimination of a large amount of detail, apart from the cost attached, is particularly beneficial at this time of labor shortage and rush of work.

Operating Advantages of Unit Construction.

The advantages of the disposition of apparatus cannot be too strongly emphasized from the operating viewpoint. While the economic advantages as to low unit cost are great, the advantages as to operation are even greater. All apparatus in any way connected with the functioning and operation of the circuit is close together, on the same floor, readily viewed at

Fig. 3.—Feeder Cabinets in Process of Completion, Showing Apparatus in Course of Being Mounted in Respective Locations.

once. All apparatus can be easily supervised and controlled, thus eliminating that class of mistakes that may arise where apparatus is widely scattered and on different floors. While all apparatus is compactly located, congestion is absent. While all parts are amply protected, each part is readily accessible. The arrangement is flexible to the extreme, and conveniently so, since an operator can do all switching and paralleling of circuits or regulators on the one floor and with a minimum of exertion and loss of time. Present-day requirements are such that simple fool-proof features, safe yet cheap, flexible yet not complicated, are necessary. The above arrangement meets all of these requirements.

The unit form of construction described, with its low cost, its simplicity and ability to permit duplication on short notice and where labor is variable and not of the best, assumes particular interest at this time when quick extensions are required to be made, and where costs of construction have to be curtailed. The high price of copper, the economy of good voltage regulation, the ability of the automatic voltage regulator to accomplish so much more cheaply what otherwise would have to be obtained by additional copper, the scarcity of copper as well as the men to string it, the greater return from regulators than copper, makes the above method of cutting construction costs and counteracting the shortage of time and skilled labor of more than passing interest to those having similar problems to meet.

ELECTROCHEMICAL PROGRESS NECESSARY TO WAR.

President of Society Shows Rapid Development of Past Year Has Been Factor in Preparedness.

Colin G. Fink, president of the American Electrochemical Society, has recently given a review of the triumphs of the electrochemical industry in the United States for 1917. The production of raw and finished materials so essential to the equipment of our army and navy was accomplished by providing the necessary cheap power for the operation of factories and shops. Among the materials to which prompt attention was given were the ferro-alloys, and special steels; and the abrasives, alundum and corundum; the graphite electrodes and aviation alloys. Through the influence of some of the country's electrochemical engineers the Government had become interested in national legislation designed to meet the power crisis by encouraging the utilization of available water power.

The electric steel industry's remarkable growth was evidenced by the fact that the number of electric steel furnaces had increased from 136 in 1916 to 233 at the close of 1917. It is shown that in electric steel products our nation leads the world, our nearest competitor being Great Britain, with 150 electric steel furnaces in operation in 1917. This rapid growth has been due to the demand for special and high-grade steels, made better and more cheaply by this process than by any of the older methods. Dr. Fink asserts that no other steel can compare in quality with the electric steel. The change to electric steel is the most important and radical since the days when the Bessemer process was first adopted.

The two 25-ton and two 15-ton electric furnaces in use at the works of Illinois Steel Company, South Chicago, with a third furnace of 25 tons under construction there, were referred to. He makes special mention of a new type of electric furnace introduced in 1917 by William K. Booth and J. R. Hall, two American engineers. A feature of this was an auxiliary electrode, making positive the starting of each heat, and rendering unnecessary the trouble of making contact. Its conducting hearth, giving uniform heating of the entire bath, and speedier and more thorough distribution of the heavier alloys, was mentioned. He refers, also, to the new Greaves-Etchell electric furnace, developed in 1917, in England.

The subject of the fixation of atmospheric nitrogen is taken up. The importance of nitrogen as an essential constituent of modern explosives and its equal importance as an element in soils for the production of food were emphasized. The Government's development of ammonia and nitric acid plants in this country was referred to. Kilburn Scott's new nitric acid process was introduced in this country in 1917. By this, oxides of nitrogen are produced by passing air through an electric arc; and this is subsequently transformed into nitric acid and nitrates. This furnace, which has been in operation for some time in England, is to be put in use in this country, in accordance with plans in progress.

The United States produces nearly two-thirds of the world's output of electrolytically refined copper, the American electrochemical refineries having increased their capacity from 1,250,000 tons in 1916 to 1,400,000 tons in 1917. He refers to the United States as being the only producer of electrolytic tin in the world. The purest metal thus far produced is from tin ore imported from Bolivia, which is smelted and electrolytically refined.

The increased demand for aluminum, which greatly overtaxed the American aluminum factories, was met by building and putting in operation an electrochemical plant at Baden, North Carolina. The great demand for this metal has been for aircraft construction. Under the pressure of war demands, the production of magnesium has become important at Niagara Falls, where duralumin, composed of copper, aluminum and magnesia, is produced. This product is said to be as light as aluminum and as strong as soft steel. Magnesium is used, also, in a process of refining certain grades of soft steel, and for making flares and light bombs.

In like manner he deals with the production of electrolytic zinc, its uses and demands; also, electrolytic lead refining, a comparatively young industry, founded in America, the result of American inventions. Calcium carbide production in this country was referred to as an industry of increasing importance, to supply the oxy-acetylene welding and cutting operations: then the increased demands for carbide as a raw material used in the manufacture of calcium cyanide, a fertilizer, had caused new plants to be built.

The American electrochemical industries had a prosperous year, in spite of the handicap of power shortage, and the hope is expressed that legislation will be speedily put through to provide for the use of more water power.

New York Service Commission Removes Offices.—The Public Service Commission for the First District has commenced the removal of its offices from the Equitable Building to the structure at 49 Lafayette Street. The entire Division of Designs, which prepares plans for subways, has already been removed, and is occupying the eighth and ninth floors of the building on Lafayette Street.

Trend of Public Utility Interconnection

Nation-Wide Movement Toward Interconnected Generating and Transmission Systems Continues Apace, and Already Indicates the Economies of Operation and Increased Capacity Made Available by Interchange of Energy

THE present unprecedented industrial activity, the springing up of new industries, the scarcity of fuel oil in the West and coal in the East have caused central-station companies to be hard pressed to find capacity to meet new loads. Many isolated plants being unable to obtain continual fuel supplies, have gone over to central-station service, in this way further increasing growth of load. The outstanding feature of central-station progress of the last few months has therefore been the effort made to obtain increased generating capacity to meet the increasing loads, and, further, a serious movement toward the conservation of fuels.

While the ways employed have differed, the aim sought has been the same, namely, the attainment of more energy and consumption of less fuel. East and West, the problem has been the same. As the railroads have pooled their equipment, shared their business with each other, and adopted co-operation instead of competition, so electrical utilities are now doing virtually the same thing, namely, interconnecting their systems, pooling their capacity and sources of energy, and in this way obtaining the benefits of diversity and higher load-factors with the accompanying economies that accrue.

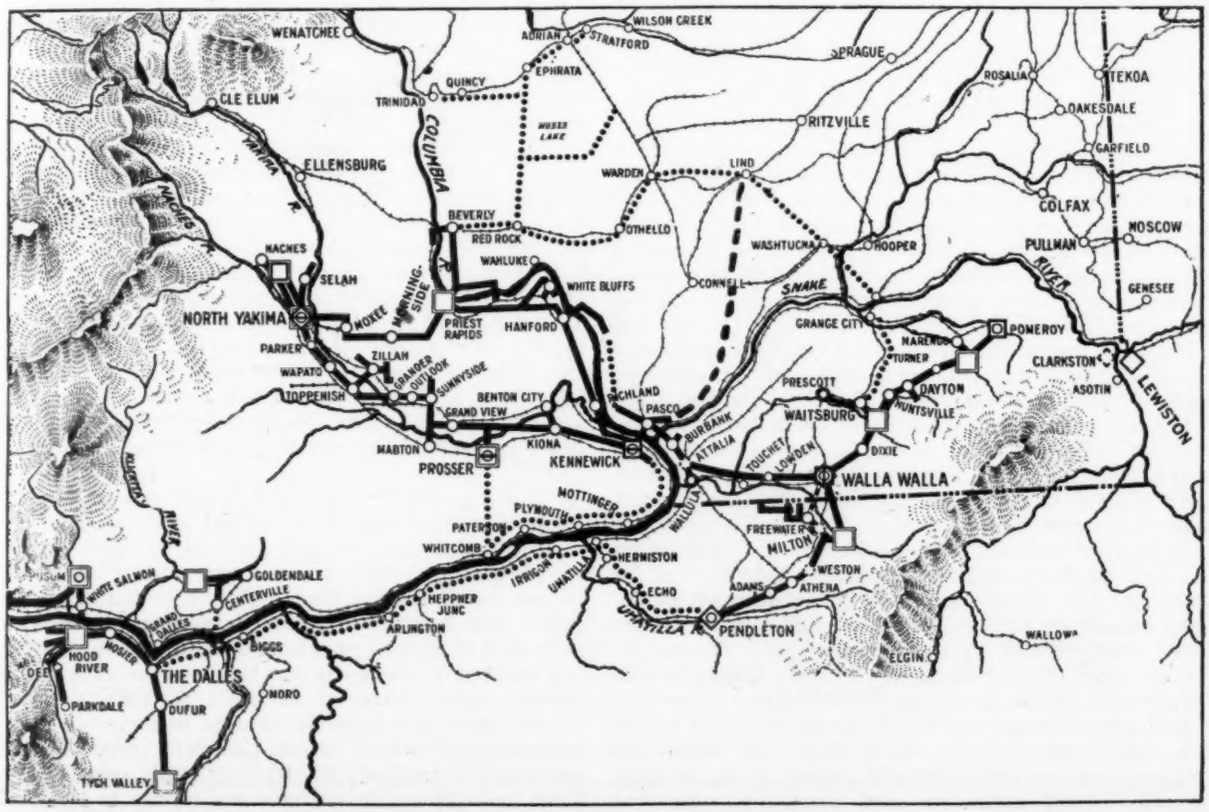
The fuel situation has brought the question of water-power development to the fore. While all are agreed that it is vitally important to use water wherever possible instead of coal or oil, there is considerable difference of opinion as to how to make this possible. There is, however, every indication that a working water-power policy may soon be promulgated such as will attract capital and at the same time not give up the property of the people for posterity to private enterprise.

Water-Power Development.

With the present live interest being taken in water-power development it is interesting to note that there is about 6,500,000 horsepower at present developed or in course of development. Of this amount it is estimated about 2,000,000 is in plants of less than 1000 horsepower. About 50 per cent of the developed water power is in five states as follows:

	Per Cent.
California	14
New York	13
Washington	10
Pennsylvania	6
South Carolina	5
	48

With California and New York State in the lead and Washington third as to the amount of water power developed, it is but natural to expect the move-



Pacific Power & Light Company Tied in with Washington Water Power and Northwestern Electric Companies.

ment toward interconnection of systems and stations should have progressed farthest in these states. Where there has been plenty of cheap power, there industry has been attracted, the demands for energy have increased, the necessity for interconnection has thus made itself felt the more acutely.

In the past interconnection has been looked upon as something that belongs to hydroelectric development. Variable water flow, lack or abundance of water pondage, stand-by steam stations as reserve against water shortage or line failures were the original predominating reasons for interconnection of hydroelectric systems. However, the interconnection of systems and stations of the same and different companies where all energy is steam generated has received a great deal of attention since the shortage of coal, its high cost and the demand for additional capacity have made themselves felt.

In California the development of water power—as elsewhere—has not kept pace with the demand for electrical energy. In the past it has often been cheaper to use steam power for peak loads, during periods of water scarcity and similar reasons when auxiliary power was required. The investment in steam generating apparatus was low compared to that necessary to furnish pondage. Today, however, conditions are very different. The price of oil has risen, consumption has likewise increased far out of proportion to the supply. The result is that attention is being forced to the utilization of water power wherever feasible, thus conserving the oil supply for naval and commercial applications where there is little other choice. The problem, therefore, in California today is to increase the oil supply on the one hand while curtailing its use on the other by using water power and hydroelectric energy in every way possible. California has already become famous for its hydroelectric developments, and yet it is probably not widely appreciated that hydroelectrical energy supplies only one-fifth of the total power requirements of the Pacific Coast. This emphasizes the vast development that yet remains to be carried out toward harnessing water power in general, everywhere.

Many surveys have been made as to water-power sites readily marketable, advantageous locations for development immediately or in the near future. The same thing has been done as to judicious points of physical linking up of systems now existent or proposed. A number of these proposals and those actually accomplished have already been mentioned in the ELECTRICAL REVIEW from time to time.

There are many instances where interconnection and increased water development can be obtained quickly, effectively and fairly cheaply. On the other hand, there are many more instances where interconnection, while desirable, cannot be accomplished without heavy expense entailing considerable work. There is a decided tendency to carefully weigh the various pros and cons of these cases. The fact is not being lost sight of that all effort should now be concentrated to winning the war, that any development carried on now which cannot be used for the prosecution of the war should be held in abeyance until a more opportune time. There are other reasons why this should be so, apart from those of patriotism. Money is now expensive, as are also materials and men. Construction carried on now at inflated prices will later handicap the payment of a return upon the investment unless rates are proportionally raised, which is undesirable. Only extensions and construction such as cannot be delayed should now be carried on.

A great deal of this proposed interconnection will come to nothing. On the other hand, much of it will. Promiscuous interconnection is just as unwise as judicious tieing in and linking up is economically and financially beneficial. Interconnection is no panacea What may be saved in cost of fuel may be far exceeded by investment upon the undertaking. The investment expense is working night and day every day in the week, whereas the investment only has opportunity to pay for itself while the investment is working—and that depends upon the load curve. There are a number of hydroelectric plants that have suffered bankruptcy because the investment was so high, notwithstanding that the actual expense of operation was low.

SCOPE OF INTERCONNECTION.

While the larger transmission companies with their high voltage lines, with wide ramifications and large capacity covering vast territories have interconnected one large station with another, so, too, have many of the smaller plants linked up their systems, generating and transmission systems for bulk, emergency and week-end interchange of energy.

By interconnection it is possible, and beneficial, to harness small water powers that would be too small to be of use alone. Thus there are many hydroelectric plants of a few hundred kilowatts to several thousand operating in parallel and generating into a common transmission system. The energy thus contributed by the small plants is not large. If it ceased it would be possible to go along without them. But they represent energy that would have to be obtained in some other way if they were not used. These small plants enable increased flexibility in the way of conductor design and operating flexibility. They mean that just so much fuel is saved or water elsewhere is available for storage purposes and use for more important work later. They mean that line failures and other causes of isolation may occur, as they will, with a minimum of effect upon service continuity. They mean in some instances better voltage regulation more economically obtained.

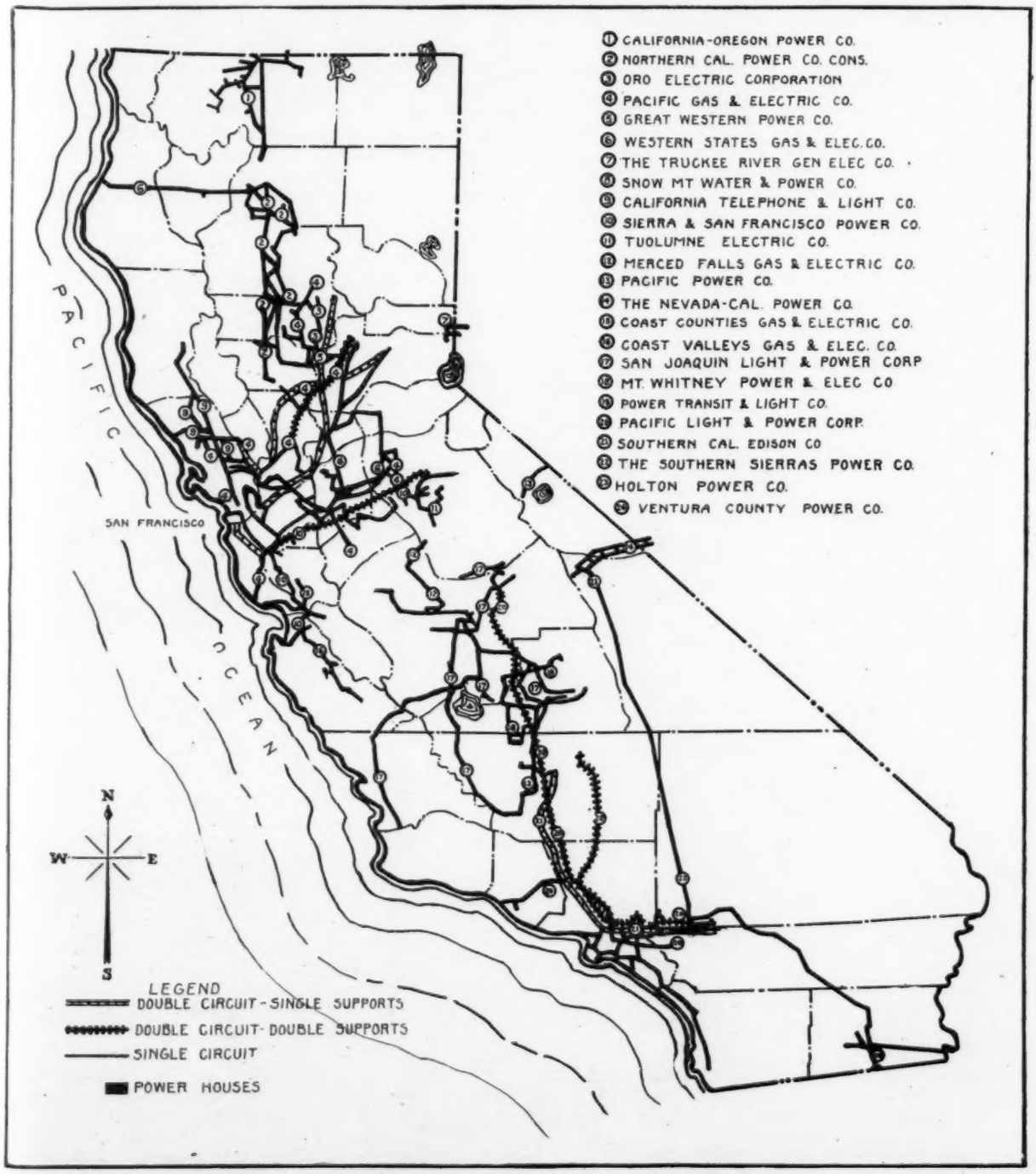
Interconnection of hydroelectric plants makes it possible to utilize pondage that otherwise would not be of use, diversity of stream flow can be utilized, excess power generated by floods may be used in the common system, saving the consumption of fuel elsewhere. With coal-burning plants conditions are much the same, except in this case it is more a matter of manipulating load factor of individual units and plants for maximum efficiency and coal saving. On the theory that everybody does not do the same thing at the same time, it follows at once that interconnection makes additional capacity available, and thus enables a greater disparity between generating capacity and connected load.

The economic value of a water power depends upon to what extent it is located in proximity to a market for its energy, and the cost of marketing it. So also, for the same reasons, interconnection makes it possible and often very desirable to harness small water powers. This phase of interconnection, conservation of natural resources and utilization of existing sources of energy is one that may be expected to receive more universal attention as time goes on. Canals may quite possibly be used in the near future to relieve railroads of certain classes of freight. Levees and various methods of draining lands otherwise of little use will enable hydroelectric energy to be developed that otherwise would not be feasible, and at the

same time reclaim land and prevent damage and loss to property and life.

It would seem that the automatic hydroelectric station has a future before it in connection with development of small water powers. Electrical apparatus is already largely automatically controlled and very largely takes care of itself as to safety, regulation and operation. The automatic water-power plant is particularly well adapted to automatic control. In the development of the small water power of from a few hundred to several thousand kilowatts capacity, it is necessary to generate energy cheaply and labor should therefore be a minimum. A small water-power might in this way prove a good investment, where if continual attendance were necessary it would not be financially desirable, because of the large proportion of operating expense occasioned by attendance. The automatic water-power plant is already well known. It should seem only a matter of time before more spring up where exists the water and the interconnection of systems to make its use desirable.

These small automatic stations offer many advantages for those cases where storage capacity is lacking, because of topographic or financial reasons. They can be operated during fall and winter when loads are heaviest and the greatest peaks occur and water is plentiful. During the summer, when less water is available, they may be left alone, since the investment


1 CALIFORNIA-OREGON POWER CO.
2 NORTHERN CAL. POWER CO. CONS.
3 ORO ELECTRIC CORPORATION
4 PACIFIC GAS & ELECTRIC CO.
5 GREAT WESTERN POWER CO.
6 WESTERN STATES GAS & ELEC. CO.
7 THE TRUCKEE RIVER GEN ELEC CO.
8 SNOW MT WATER & POWER CO.
9 CALIFORNIA TELEPHONE & LIGHT CO.
10 SIERRA & SAN FRANCISCO POWER CO.
11 TUOLUMNE ELECTRIC CO.
12 MERCED FALLS GAS & ELECTRIC CO.
13 PACIFIC POWER CO.
14 THE NEVADA-CAL. POWER CO.
15 COAST COUNTIES GAS & ELECTRIC CO.
16 COAST VALLEYS GAS & ELEC. CO.
17 SAN JOAQUIN LIGHT & POWER CORP
18 MT. WHITNEY POWER & ELEC CO
19 POWER TRANSIT & LIGHT CO.
20 PACIFIC LIGHT & POWER CORP.
21 SOUTHERN CAL. EDISON CO
22 THE SOUTHERN SIERRAS POWER CO.
23 HOLTON POWER CO.
24 VENTURA COUNTY POWER CO.
PACIFIC OCEAN
SAN FRANCISCO
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LEGEND
DOUBLE CIRCUIT - SINGLE SUPPORTS
DOUBLE CIRCUIT - DOUBLE SUPPORTS
SINGLE CIRCUIT
POWER HOUSES

California Is Served by a Vast Network of Interconnected Lines.

is a minimum. This field of the small-power automatic hydroelectric station is one that is as yet barely touched upon but which must surely assume real importance with the coming of interconnection of systems and the better appreciation of the value of water-power utilization.

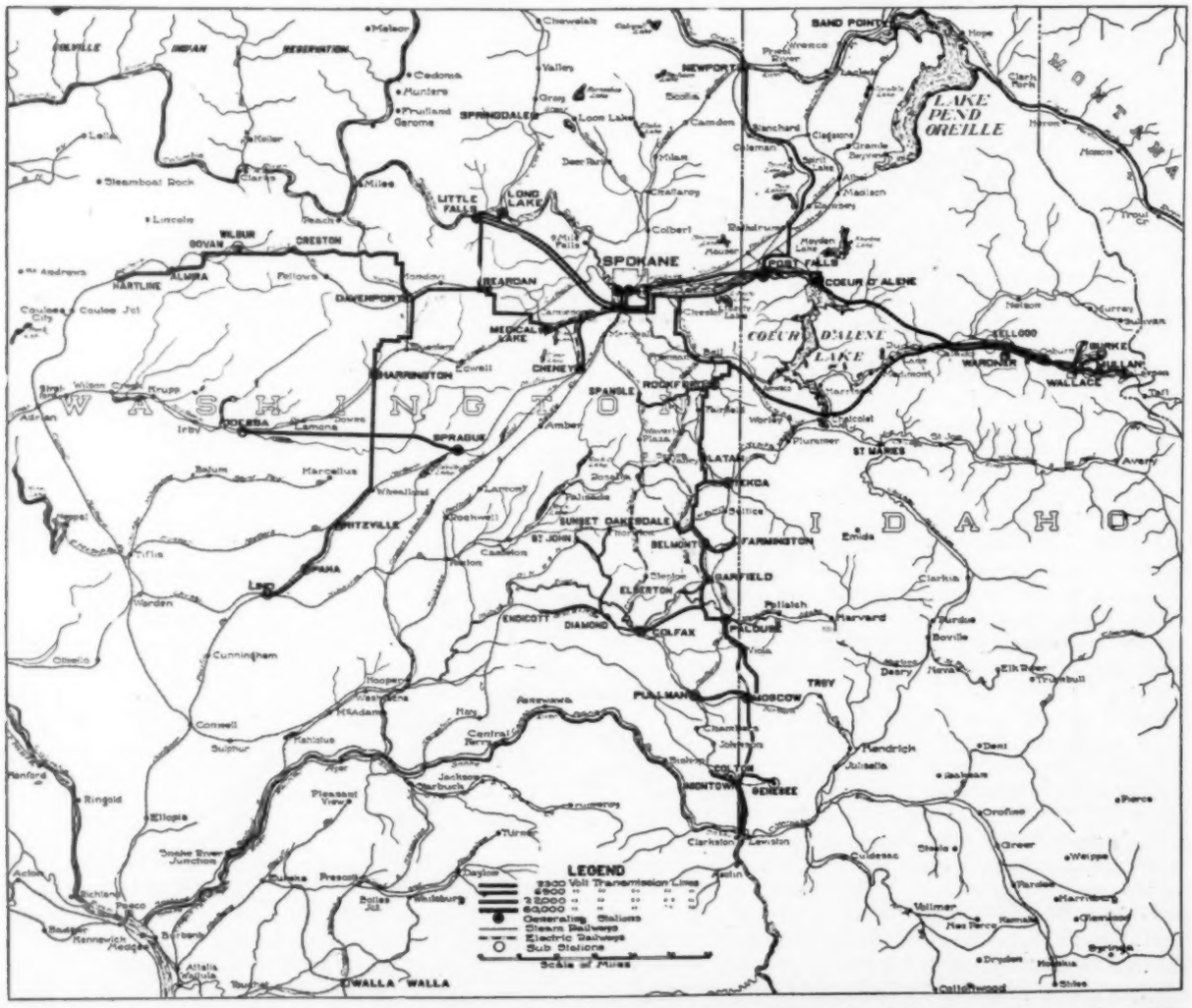
Into the scheme of things the outdoor substation will play a larger part than it has already. Barely ten years have passed since the question as to whether electrical apparatus should be installed outdoors instead of indoors was thrashed out. Yet in face of opposition by many, the outdoor substation has come, and come to stay. From now on, with wider interconnection, with the ramifications of high and medium voltage transmission and distribution lines and farmers' rural lines over the country, the outdoor substation and line construction giving strength and reliability with low cost must play a part in the solution of the problem of cheap universal energy supply.

Interconnection from Aspect of Rates and Public Opinion.

To what extent energy rates may be expected to be decreased as the result of operating economies is, of course, a question difficult to answer. In fact it would appear that in some instances interconnection would necessitate rate increases rather than reductions, because while the cost of fuel may decrease the investment necessary to make interconnection possible has increased. It is particularly interesting in this connection to notice that the Great Western Power Company and Pacific Gas & Electric Company have recently applied to the California Railroad Commission for a 20 per cent rate increase for nearly all users except "domestic consumers." As recently mentioned in Electrical Review these two companies and the Sierra and San Francisco Power Company recently unified their systems and thus set a world's record by supplying some 40,000 square miles by one system under one management. It is possible that the 20 per cent rate increase sought creates another world's record also.

One very noticeable feature of the interconnection that has already taken place in many places is the attitude of the public toward the movement of linking up of companies. Hostility and suspicion has apparently entirely disappeared. The monopoly scare appears to be dying a natural death, as the public realize that the utilities and ample energy at low rates are necessary in winning the war now and a vital factor in conservation of the nation's natural resources. Moreover, all now appreciate that coal and oil and gas as well as water are national assets to use and not abuse.

The requirements for electrical energy are endless, for electrochemical processes, mining, irrigation, agri-



Washington Water Power Company Connects With Montana Power and Pacific Power & Light Companies, and Soon Will Connect With Puget Sound Traction, Light & Power Company.

culture, industrial and domestic applications of light and heat and power, and last, but not least, eventual railroad electrification. It is certain, therefore, after the lessons of the last year, that the future will see activity such as not previously known for the better utilization of existing sources of energy, the amalgamation of these various scattered sources into efficient networks by interconnection of systems and plants.

LARGEST HIGH-HEAD FRANCIS TURBINE.

Puget Sound Traction, Light & Power Company Installs 25,000-Horsepower Unit, Which Is Largest Hydraulic Turbine of Its Type.

The Puget Sound Traction, Light & Power Company, Seattle, Wash., is installing a new turbine unit in its White River hydroelectric plant in the vicinity of Sumner, that state, of 25,000 horsepower capacity. The two original units, which were installed in 1911, have a rated capacity of 36,000 horsepower, but in actual practice have carried a load of 44,000 horsepower. This equipment, which includes Francis turbines, was built by the Allis-Chalmers Manufacturing Company, the plant having been designed and installed under the supervision of Stone & Webster, engineers.

The new unit being installed consists of equipment similar to that of the two units now in use, the new Francis turbine, however, having a capacity of 25,000 horsepower, which is the largest of this type ever built. The accessory equipment includes some new features for regulation and control to meet conditions which exist.

To Supply New Electrified Zone.

The new installation is being made primarily to supply the power required by the Chicago, Milwaukee & St. Paul Railway Company to operate passenger and freight trains over the Cascade Mountain division in Washington. The electrification of the part of its main line from Tacoma and Seattle easterly to Othello, near the Columbia River, has been in progress since May 1, 1917. The work covers a stretch of about 200 miles, and is to be completed later this year. That part of the division extending from the summit of the Cascade range to Seattle and Tacoma, it is understood, will require 25,000 kilowatts, and this energy is to be supplied by the Puget Sound Traction, Light & Power Company. The economy and efficiency attained by the C., M. & St. Paul in electrically operating 440 miles of its Rocky Mountain division in Montana for the last 18 months not only justified the electrification of the Cascade division, but made available reliable bases upon which to figure construction and operating costs. The Cascade Mountain division is not only within a territory of great hydroelectric power, both developed and undeveloped, but it cuts through the coal fields of western Washington, the output of which is rapidly increasing.

The White River plant, herein considered, is only one of several hydroelectric plants operated by Puget Sound Traction, Light & Power Company in western Washington. The White River, which heads in the glacial regions of Mount Ranier and flows westerly into Puget Sound, is subject to the variations in volume that is characteristic of mountain streams. The first step in the development of this hydroelectric power was in the construction of a timber-crib dam on this stream, close to Buckley, a coal mining town some distance upstream from Sumner. Heavy steel gates at this dam control the discharge of water into a wooden flume by which it is carried to a forebay in which much of the silt carried down by the stream is settled; and it is so arranged that the forebay may be drained and flushed to get rid of the silt. The water, thus clarified, is carried in open canal to the main storage reservoir, known as Lake Tapps. This is an enlarged natural lake-bed, the inclosing boundaries having been built up to hold water at a level of 35 feet, giving the basin a storage capacity of about 2,250,000,000 cubic feet, water from which is delivered to the power plant at 440-foot head.

Dam Construction.

The open canal and tunnel, through which 3000 cubic feet of water per second is carried from Lake Tapps, discharge into a concrete-built forebay overlooking the power plant. Water is conducted from the forebay to the turbines through 8-foot steel conduits. In order to meet the variation of power load in the system, especially that variation due to the pulling of heavy freight trains up grade, hydraulic control equipment was installed. In this problem the requirements as to water conservation and speed regulation under extreme fluctuations of power over high-tension transmission lines were specially considered. One requisite was the installation of turbine governors sufficiently sensitive to prevent excessive variation in speed and voltage, and another was to provide for quick control of turbine gates so as to obviate the effect of sudden changes in flow of water through the tunnel and pipe lines. A surge tunnel, built between the tunnel outlet and the pipeline intakes, was designed to prevent surges of water through the tunnel from exerting excessive pressure in the steel pipes. It was also decided to use pressure regulators in connection with the turbine to effect a release of water when cut off by the governor suddenly closing the turbine gates. This release, or bypass, then automatically closes so gradually that the flow of water ceases without producing a secondary-pressure rise. Another plan adopted was to put in air-cushion tanks from which hydraulic pressure on the turbines is drawn at times when the power demand suddenly rises, and when at such times the pipe-line volume would be insufficient to meet the required pressure on the turbines. The necessary speed regulation is secured by the effect of these accessories acting together, and in connection with the fly-wheel effect of the revolving parts of the generator.

Details of Present Equipment.

Some facts descriptive of the two original units will be of interest, as the features of those units are being adopted for the new turbine-generator unit being installed. The turbines of the two initial units are the double-discharge type, on a horizontal shaft, with spiral case, operating at 360 revolutions per minute, under a head of 440 feet. The water for these turbines passes from the penstocks through steel valves, butterfly type, having an inside diameter of 7 feet, each valve gate sustaining a normal pressure of 1,000,000 pounds; and this is greatly increased on occasions of the maximum pressure exerted when the valve is closed against the full penstock volume. The runner receives water through a scroll-type steel casing, by which it is delivered in a direct, steady volume. Steel guide vanes, between which the water passes on its way to the runner, furnish the means by which the volume of water is regulated by the governor to meet the load requirement of the generator.

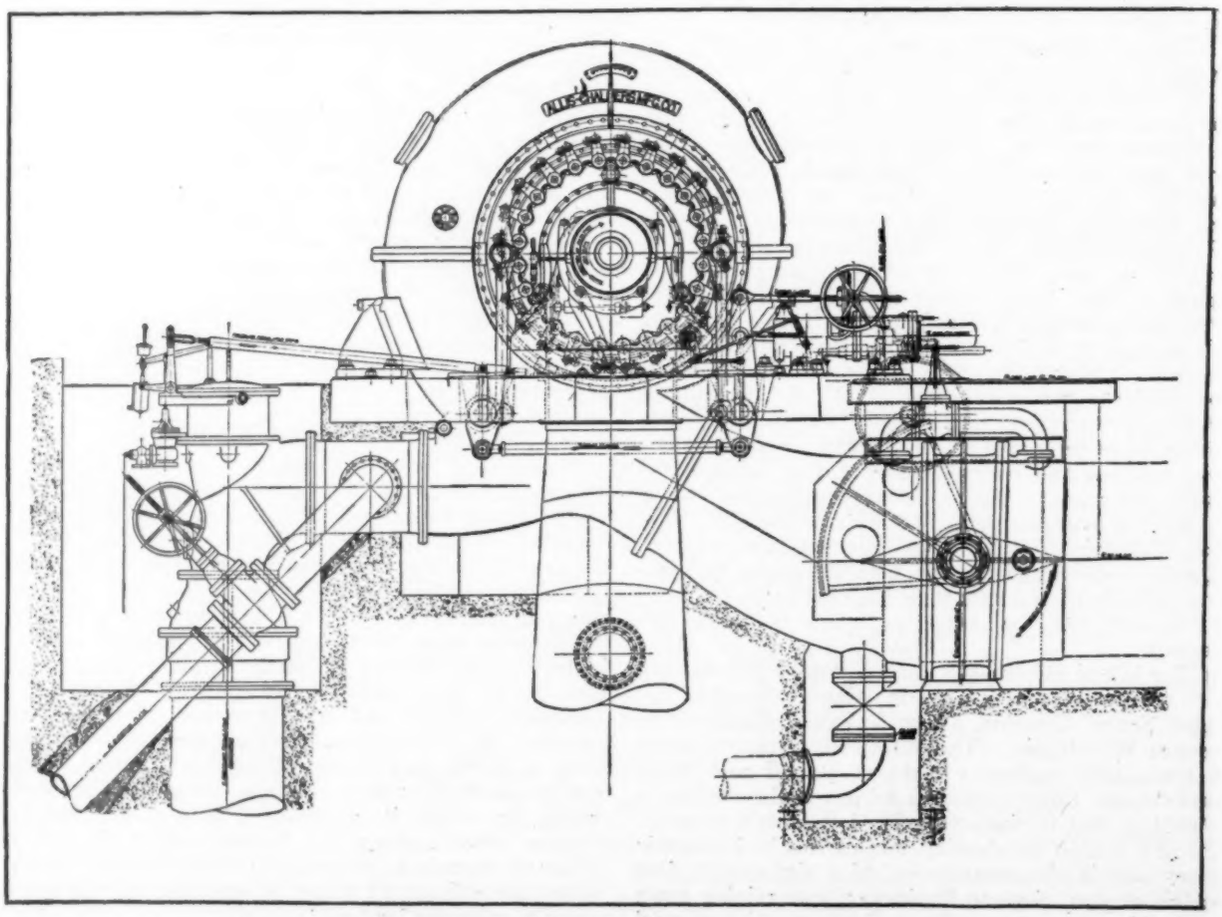
The runner is held in position on the turbine shaft by bolts fastening it to a forged flange on the shaft. The runner, being the double-discharge type, divides the water into two equal volumes, these discharging through a quarter turn and a tapered steel draft tube. The turbine shaft runs on two bearings of ring-oiling type, having ball-and-socket seats. The end that connects with the generator has a solid flange for this purpose; the mechanical hand brake, by which the unit is brought to a stop, is connected to the opposite end. The spiral casings, brake, bearings and other parts are held by bolts to a cast-iron bedplate, grouted into the foundation. The guide vanes, operated from a steel shifting ring outside the casing, are held in three bearings; two steel rods connect the shifting ring to the bell crank levers, which are actuated by a regulating piston, guided by a crosshead. The oil pressure, on both sides of the regulating piston, is controlled by a double-acting, hydraulically-balanced regulating valve bolted to the governor stand, which contains the governor devices. The capacity of the governor in each case is 50,000 foot-pounds, by which the turbine gates may be moved over their complete stroke in one second. A pressure regulator, consisting of an elbow with circular disk valve, is connected to a branch pipe on the lower portion of the spiral casing. It opens and discharges the water through a steel pipe to the tailrace.

Tests showing the efficiency of these turbines have been made, and the plant has developed the highest economy in the use of water, and the large storage capacity of its reservoirs provides for an ample supply during periods seasonal low water.

Utility Companies Request Suspension of Rules.

The Springfield Gas & Electric Company and the Central Illinois Light Company of Peoria have appeared before C. M. Tinney, chief examiner, Illinois Public Utilities Commission, and asked that Rules 19 and 31 of the Commission be suspended during the period of the war. Rule 19 is to the effect that electric connections must be made free to new consumers for a distance not to exceed ten pole lengths, the installing company being allowed to charge for longer extensions than that specified by the Commission in the rule. In a similar way Rule 31 applies to gas connections, providing that gas companies install gas mains to a certain length free of charge. The two companies appearing before the Commission contend that the operation of these rules should be dispensed with during the period of the war, on account of the high cost of labor and materials and because of a desire expressed from many public officials that unessential construction be postponed until after the war. The companies further ask that they be not compelled to furnish gas or electricity to any new consumers where additional poles or new mains are required.

Inspection Trip of Ohio Engineers.—Members of the senior engineering class of the College of Engineering of Ohio Northern University, Ada, Ohio, started on their western inspection trip February 25 and spent several days of the week in Chicago. They visited a number of engineering works and industrial plants, and went thence to Buffington, Gary and Ft. Wayne, Ind.



Sectional View of 25,000-Horsepower Francis Turbine.

Editorial Comment

Standardization of Station Construction

IT IS NOW universally agreed that under present conditions only such work as is necessary to meet urgent demands or keep apparatus and plant in efficient condition should be performed by central-station companies. It is, moreover, appreciated that whatever work is done should be done as cheaply as possible.

Construction work must go on, deteriorated apparatus must be rehabilitated, extensions must be made, since to cease going forward is to lag behind, and notwithstanding all manner and methods of retrenchment and curtailment, every effort should still be made toward prosecuting as efficiently as possible whatever has to be done. As bulk production permits rapid output at low unit cost, whether in the manufacture of automobiles or aeroplanes, so with central-station construction. For this reason central-station construction costs are usually relatively high, compared to what they would be were the work done as the main undertaking of the company, instead of as one of many items in attaining a goal, although standardized construction carried on by a holding company may be an exception to this statement. However, the greater the amount of similar work carried on the greater the opportunity to cut cost, in the same way that a manufacturer or contractor is able to do. With bulk production, whether of substation equipment, substations or hardware, comes the opportunity to standardize methods, which of course is a radical stride toward cost reduction.

For many central-station companies erecting a power house, or installing a unit in an existing power house, is an uncommon occurrence, possibly a rarity. On the other hand, building a substation, installing customers' substations, erecting outdoor transformer banks and line construction are matters that occur oftener, and thus offer inducements toward cost reduction and improvement through the process of evolution and eventual standardization. Where standardization comes it should be the survival of the fittest, safety to persons, service and equipment, flexibility, and, when compatible with these, low unit cost. While standardization has its advantages hasty or premature standardization is undesirable as it may tend to hinder improvement and restrain normal development. Moreover, standardization in construction methods and station design should start from the aspect of safety to men and service and after aiming to have these a maximum should then progress toward cost reduction.

Elsewhere in this issue is described a method of construction employed by the Commonwealth Edison Company that offers many suggestions as to station design and layout, methods of construction and reduction of costs, simplifying the work of the engineering and construction departments and thus offsetting somewhat the present-day labor situation, at the same time improving operating and safety methods. The method described is that applied to only one branch of central-station construction of which a number of installations are made annually. It is equally applicable, with modification, to other classes of installations, since the underlying principles of safety, reliability, space economy and low unit cost are basic.

It might be pointed out, however, that the unit cost has not been as low as expected, although the enormous increase in cost of asbestos is one reason. As to safety and operating desirability, however, little remains to be desired, and it is the very complete safety features employed by the Commonwealth Edison Company in all its work, of which the described installation details are typical, that resulted in its being awarded the medal for safety by the American Museum of Safety three years ago.

Spring Construction and Maintenance

SPRING is practically here, an exceptionally welcome spring after an unusually long and severe winter. The revival of construction activities customary with nature's vernal reawakening is sadly lacking this spring, however. Grim war is spreading its mastery over the land and demanding that its almost insatiable needs be met first. Aroused to the importance of doing its share honorably and thoroughly, the country is making winning of the war its chief business. All activities which would deplete the resources that the nation needs so urgently in this gigantic undertaking to insure world-wide justice and peace are being checked more and more.

Building is one of the first industries to be placed on the restricted war basis. Only such new building is being done as is clearly required to meet war needs, which means chiefly government, military and naval establishments and plants supplying the great quantities and varieties of munitions, including ships. An important need of all such plants of modern type is electric power, the increased demand for which is causing quite a few central stations to be enlarged as well as several new ones to be built. Aside from this exceptional activity in a relatively small number of favored communities, electrical construction work throughout the country at large is very quiet.

The customary spring activity in building new extensions to electric lines has been halted before it was even begun this year. Even the rehabilitation of lines to overcome the ravages of a severe winter is being

curtailed and in some places the unheard of policy is threatened by keeping down ordinary maintenance to a minimum on the score of economy. While economy is especially praiseworthy during war times, economy carried to this extreme would be so shortsighted as to defeat its ends. The folly of actually carrying out so absurd a policy is pointed out in an article on other pages of this issue.

Ordinarily, nothing is done to prevent the manager of an undertaking from committing business suicide, if this does not involve hardship on innocent investors. The supply of electrical energy from a central-station system has evolved from a public utility into a public necessity, and the country's need for economical and reliable energy supply is now so great as to preclude the possibility of tolerating failure of this supply through willful neglect to maintain the generating and distributing equipment in dependable condition. Even where electric service is not utilized for the production of munitions of war, it is a means for promoting the fuel economy still so much needed to ward off another coal famine next winter.

Two men at the head of the nation's momentous affairs, President Wilson and Secretary McAdoo, have recognized that the service of public utilities is essential to our winning the war and are urging that these utilities be aided to every reasonable extent so they may render their service unimpaired. The general sentiment throughout the country backs up the statement of our leaders in this regard. Where the costs of rendering electric service have increased so much as to make higher rates justifiable, the public is very much more anxious to pay these higher rates than be deprived of the continuity of the service, which would be a certain outcome of failure to maintain the equipment in first-class condition at the very time when the service was depended on to a greater extent than ever.

It is expected, therefore, that even though we may not have the usual spring construction activities in the way of new extensions, we may at least have unimpaired maintenance and, if possible, of a higher order than customary. What is desirable, indeed, is exceptionally thorough rehabilitation of plants and lines to make them capable of rendering demands for reliable service that are greater than ever. To still further increase the capacity, reliability and economy of supply without much new construction, let us interconnect plants and systems the country over into a gigantic co-operative electrical network at the service of the nation in its greatest time of need.

A Power-Hungry World Turns to Husbanding Its Resources

ONE result of the war has been to create a world-wide demand for increased amounts of power. In England the annual consumption of electrical energy has more than doubled in three years. France, robbed of her chief coal resources, and needing power as she has never needed it before, has turned her attention to hydroelectric development in the Pyrenees and Alps with the result that today she is credited with one plant of 250,000 horsepower and a total of more than 5,000,000 horsepower in central stations. Italy, without coal of her own, with her former sources of supplies interrupted and harassed by submarines and shortage of ocean-going bottoms, too, has had to turn to hydroelectric development. Germany's production of electrical energy is reported to have increased from 2,600,000,000 kilowatt-hours in 1913 to over 10,000,000,000 in 1916 and she is now understood to have plans well matured for complete electrification of her railroads and the erection of numerous large interconnected stations to utilize her own and Austrian water power, the vast turf and peet deposits, as well as coal. Even far-distant Australia has plans under way to interconnect her systems and obtain more power.

Here in America the demands created by the war, the fuel shortage, inability to install apparatus to keep pace with even normal growth because of embargoes, high prices and difficulties in obtaining deliveries, have caused every means to be evolved holding promise of increasing available capacity and saving fuel. Interconnection of power plants and systems has been the outstanding method of meeting both these requirements—killing two birds with one stone, as it were—for the linking up of various systems into unified systems has already made rapid headway.

The recent fuel situation, as regards both oil and coal, both of which are now under control of the Fuel Administrator, has forced attention with renewed vigor to undeveloped water power. Many near-by water powers there are that may be made available for use with little trouble, expense or delay. Others there are partially developed, but lacking pondage to make them of maximum usefulness. Interconnection of power plants and systems will bring in many of these sources of power otherwise of little value, and enable them to do their bit in winning the war by making available badly needed energy and saving coal or oil. Where the interconnection of hydroelectric systems enables diversity of stream flow, water pondage, and local diversity to be taken advantage of to obtain increased power by interchange of energy between those systems that have excess to those that have insufficient, so, too, steam plants by interconnecting and pooling their capacity are able to serve greater loads and conserve fuel by eliminating the smaller and less efficient plants, by operating at higher and more economical load factors.

Interconnection of plants and systems is no longer a private affair for agreement between individuals. It is a matter for state concern, through public utility commissions, and of the nation through the Fuel Administrator. In unity there is strength, and our electric generating and transmission systems are strengthened by unification or interconnection.

Week's Events

Utilities Need Relief—Hearing on Rates for Break Down Service—Water-Power Legislation Rushed—Other News

UTILITIES NEED IMMEDIATE RELIEF.

Committee Representing Utility Associations Presents Report Showing Effect of War

A committee composed of P. H. Gadsden, E. K. Hall and H. H. Crowell, representing four national associations of public utilities has presented a report, addressed to the American Electric Railway Association, National Electric Light Association, American Gas Institute and the National Commercial Gas Association, which deals with its findings in regard to war conditions. The report is as follows:

The undersigned, appointed to represent the four National Associations in the matter of bringing to the attention of the authorities at Washington the critical situation in the public utility industry as brought about by war conditions, submit the following report:

It is the opinion of your committee that, if the credit of the public utilities is to be preserved, there are four phases of the situation which must be taken care of:

(1) Rates must be increased sufficiently to absorb the increased costs of producing the service.

(2) The utilities must be relieved during the period of the war of all non-essential and unproductive requirements, such as paving, undergrounding of wires, duplication and unnecessary extension of service.

(3) Some way must be found to enable the utilities to take care of obligations maturing while the war lasts.

(4) Assistance must be provided to enable the companies to finance the unavoidable extensions of service made necessary by the nation's war program.

This analysis of the situation was presented by your Committee to the Comptroller of the Currency, and was supported by compilations of data and information.

The Comptroller in his report to the Congress called attention to the conditions confronting public utilities in a concise and comprehensive statement, which has already been given wide publicity, and a copy of which is herewith submitted.

As a result of this analysis of the situation by the Comptroller, supplemented by additional information and representations to the Treasury Department by your Committee, Hon. William G. McAdoo, Secretary of the Treasury, presented the matter to the attention of the President in a letter dated February 15th, 1918. This letter set forth the fact that continued and effective service on the part of the public utilities was a most essential and fundamental part of the war program, and outlined the difficulties which the utilities were having in adjusting their rates to meet the increased costs of doing business under present war conditions.

Under date of February 19th, 1918, the President replied to the Secretary expressing the Nation's interest in the proper solution of this problem.

The Capital Issues Committee, which will be made a part of the organization of the War Finance Corporation, and before which your Committee had a hearing lasting practically an entire day, has already stated that the policy of the National government will be to discourage the sale of securities, either public utility, municipal, state or otherwise for non-essentials. It will be the policy of the government to mobilize all money, labor and materials for the successful prosecution of the war, and eliminate for the period of the war non-essential expenditures. When this policy is finally put into effect through the enactment of the War Finance Bill, it should mean that the companies will be relieved of non-essential expenditures, such as unnecessary paving, undergrounding of wires, etc.

As to the matter of financing maturing obligations and extensions and improvements necessitated by the War program, provision is made for this in the War Finance Bill, Senate No. 3714, reported on February 21st by the Senate Committee on Finance. The latter Committee gave your Committee a hearing and have inserted in the bill a clause designed to cover the needs of public utilities as follows:

(D) To make advances directly (1) to any corporation owning or controlling (directly or through stock ownership) any railroad or other public utility, and (2) to any firm, corporation, or association conducting an established and going business whose operations are necessary or contributory to the prosecution of the war: Provided, That such advances shall be made only in such cases as the board of directors in their discretion shall determine to be of exceptional importance in the public interest. Such advances may be made for periods not exceeding five years from the passage of this Act, upon such terms and upon such security and subject to such rules and regulations as may be prescribed from time to time by the board of directors of the Corporation, with the approval of the Secretary of the Treasury. The Corporation shall have and retain power to require additional security from time to time.

The outlook for the public utilities, decidedly more encouraging than it was two months ago, may be summarized as follows:

(1) In the matter of rates, the President of the United States, Secretary of the Treasury and the Comptroller of the Currency, have officially recognized that it is in the public interest that public utilities be maintained at their maximum efficiency and their rates be adjusted to meet the increased costs of doing business.

(2) The National Government through the Capital Issues Committee has outlined a National policy seeking to discourage unnecessary employment of money, labor and materials during the period of the War.

(3) The War Finance Bill, now on its passage, makes provision for financing the maturing obligations of public utilities and provides a method for financing necessary extensions and enlargements.

We understand that it is your intention to send out

a bulletin containing the letters of the President, Secretary and Comptroller of the Currency.

We recommend that the National associations also take steps to present this general matter to the Commissions in the different States as a National question, entirely disassociated from any concrete local question of rate increases for any particular company. We are handing you copies of a brief containing part of the data presented to the officials of the Treasury Department, thinking you may find it of assistance in this connection. Until the general situation has been taken up in this way with the various State Commissions, we suggest that you urge your members not to formally submit to the Commissions the President's and the other letters, except in instances where they are immediately necessary in pending cases.

We recommend that you arrange to furnish your members with as many copies of the bulletin containing these letters as they may require, and that they be distributed generally among the officers and employes of the various companies.

You will notice that the last sentence of the President's letter to the Secretary reads as follows:

"I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests."

The Committee calls attention to the fact that the authorities in Washington are already overburdened with tremendous and overwhelming responsibilities, and suggest that under the circumstances members should appeal to Washington only in cases of imperative necessity, and then only after first consulting with the Secretary of their own Associations.

LIMITATIONS TO A CENTRAL-STATION COMPANY'S OBLIGATION IN FURNISHING BREAKDOWN SERVICE.

Hearings Before the New York Public Service Commission Bring Out Facts Pertinent to This Question.

How far must a central-station company go in furnishing energy to a private plant, which may be in the relation of a competitor to the former, in furnishing current for so-called break-down service? This question has given rise to much discussion. Facts of interest were brought out concerning it at hearings before the New York Public Service Commission on February 23.

Upon this occasion occurred the final testimony in an adjourned hearing of case No. 2279 of the New York Edison Company versus Acker, Merrall & Condit Company, complainant, as to alleged failure of the former to furnish break-down service.

In the first part of this hearing, P. R. Moses, an engineer of 366 Fifth Avenue, had testified with respect to the private plant now installed on complainant's premises. The Edison Company bases its refusal to furnish the auxiliary or emergency service on the ground that complainant would be a competitor of the Edison Company and would seek to furnish service to tenants in adjoining buildings on the capital of the Edison Company.

Case No. 2280 was a hearing called on motion of the Commission itself for the purpose of inquiring into and determining as to the broadest features of this important subject.

Prominent central-station men of the vicinity of New York were present. Among them were J. W. Lieb, vice-president of the New York Edison Company; Arthur Williams, general commercial agent of the same company; W. F. Wells, vice-president of the Brooklyn Edison Company, and Ray Palmer, general manager of the New York & Queens Electric Light & Power Company.

In case No. 2280, the Commission sought to bring out a number of fundamental facts which will doubtless be of value not only to the electrical industry but to the Fuel Administration as well. C. E. Stewart, president of the Fuel Administration of New York City, was present at the hearing.

Summed up briefly, the points upon which information was sought were:

Whether the practices, regulations and methods of electrical corporations in regard to break-down service are in any way unjust or unreasonable.

Whether the property and equipment of the central-station companies for such purpose is unsafe, inefficient or inadequate.

Whether the rates for such service are unjust or discriminatory.

Whether changes, additions or improvements in the equipment, service or regulations are desirable.

Whether different rates than those in effect should be prescribed.

From the central-station standpoint, that is, central stations in this jurisdiction and subject to its regulations, it is unjust for the central-station company to be obliged to furnish break-down service to a private plant when this plant seeks to furnish current to tenants in adjoining buildings. In the case of the New York Edison Company, it has refused to furnish current under such conditions, maintaining that the private plant is a competitor of the New York Edison Company and trying to do business on the capital of the latter. Of course, the New York Edison Company does not so refuse when the current is all to be used in the building occupied by the private plant.

Interesting facts were brought to light in examining the witnesses in the two hearings.

Mr. Williams stated that the number of private plants in New York City is approximately 600. From the broad national conservation standpoint it is more economical to furnish current for light and power from central-station sources and then to use the boilers of the private plants to generate steam at low pressure for heating purposes. That is, less coal would be used in this way. He pointed out that the function of the steam engine and its steam consuming auxiliaries in a private plant in as far as the heating possibilities of such a plant is concerned, is nothing more than that of a reducing valve to create low-pressure steam.

A point brought out later by Mr. Lieb bearing upon this was that in the latitude of New York the maximum heating and maximum lighting requirements in a building do not coincide, the former coming, often, two hours ahead. This further controverts the impression that the isolated electric plant with steam-heating auxiliary service is working under ideal conditions.

Mr. Lieb when questioned upon the matter reported that over half of the 600 private plants above mentioned had break-down service connections. That requests for similar service were coming to them at the rate of 30 or 40 a month in the last few months. Ninety per cent of the plants now connected for such service are now making use of it each day. Incidentally, 62 private plants had been closed up in the last year.

When the question came up as to the advisability, from the standpoint of conservation, of encouraging

private plants with break-down or emergency connections, to more frequently make use of central-station service during the warm months of the year, Mr. Lieb emphatically stated that his company had no such thing as summer off-peak capacity.

Repairs of all heavy generating machinery such as turbines, etc., are always made in the summer, resulting in one or more units being non-available. In reality they have less spare capacity then than in the winter, and sudden heavy loads on dark summer days are harder to meet than in winter.

The hearing was continued to March 4. More complete data will be furnished by the central-station companies at that time as well as arguments on the other side from representatives of the Hotel Association of New York City and other private-plant owners.

WATER-POWER LEGISLATION TO BE RUSHED.

Congress to Consider Bills on March 18—Haste Urged by Cabinet Officers.

Plans for quick action on water-power legislation have been announced by Chairman Sims of the House Interstate and Foreign Commerce Committee. Hearings will begin Monday, March 18, and run to March 23. Mr. Sims asked all who wanted to be heard to notify him at once.

Secretary of War Baker, Secretary of the Interior Lane and Secretary of Agriculture Houston wrote to Mr. Sims a joint letter urging all possible haste. The letter which was made public is, in part, as follows:

"On account of the conditions now affecting the power industry and the need of maintaining our entire industrial machinery at its highest efficiency, a satisfactory solution of the water power problem is, in our judgment, one of the most important steps for the consideration of this Congress.

"The industrial expansion which has been necessary in order to produce the materials and equipment needed in the prosecution of the war has placed unprecedented demands upon the electric power industry to such an extent that the output of commercial central stations has increased more than 60 per cent since 1914. This increase has been greatest in the manufacturing sections of the East, where water-power development is comparatively limited and has been chiefly in the form of steam generated power, because steam power can be developed more quickly and at less capital cost than water power.

"There is also need of legislation in order that time may be given to prepare for the developments that must take place after the close of the war if the United States is to maintain its proper place in world trade, or even to supply its domestic needs. A survey of our water power resources is needed, particularly with relation to specific districts and specific industries.

"The various establishments of the Federal Government which have had to do with the administration of water power should be co-ordinated through a single agency, and, as far as practicable, all agencies, Federal, State and private, should be brought into co-operation. It is urgently recommended that a Federal Power Commission be established, as provided in the proposed bill, and be given ample authority to undertake this work of preliminary investigation.

"Beyond the need of power development as such is the need of increasing the proportion of water power, to reduce the drain on our coal and petroleum supplies, particularly the latter. Even if the coal supply was unlimited, the reduction in the demands upon labor and transportation equipment would be sufficient reason for substituting water power for steam power whenever possible."

ELECTRIC FURNACE DEVELOPMENTS DISCUSSED IN CHICAGO.

Various Types of Furnaces and Accessories Described and Their Applications Discussed.

Developments in electric furnace construction and application were presented at a joint meeting in Chicago on February 25 of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers. C. W. PenDell was chairman of the evening.

Thaddeus Baily, president of the Electric Furnace Company of America, Alliance, Ohio, presented an illustrated paper on "Baily Resistance Type Furnaces of Large Capacity." Resistance furnaces have a field of their own in lower-temperature operations, such as annealing and heat-treating, melting of brass, zinc and other nonferrous metals and alloys containing volatile metals. Baily furnaces consist of a firebrick chamber with one or two troughs of refractory material which are filled with carbon lumps that constitute the resistor and make contact with terminal electrodes at the end of the troughs. Current passing through the carbon resistor heats it to incandescence and is controlled by a selective oil switch and variable-voltage taps on a transformer. The heat is radiated to the roof and walls and thence onto the working hearth.

For heat-treating, the work is placed loosely into steel pans which at intervals are pushed into the furnace by a motor-driven pusher that at the same time discharges a pan of the treated material at the other end of the furnace into the quenching bath. The largest furnace of this type is of 600 kilowatt capacity, heats three tons of material an hour to 1650 degrees Fahrenheit, and has a hearth 7 feet wide by 20 feet long. Some of these furnaces are entirely automatic and represent a very large labor saving in operation. Frequently they are operated in pairs and have been especially serviceable for the heat-treatment of drawbar knuckles. Car-type and recuperative furnaces have also come into use for annealing and the like; one of these 600-kilowatt furnaces is 193 feet long and 22 feet wide.

Tilting furnaces are used for melting brass, copper and aluminum. For brass these furnaces have been especially successful; the loss of metal when melting brass scrap are under 1.5 per cent. A 500-kilowatt nontilting furnace is capable of melting one ton of aluminum per hour. A 1000-kilowatt furnace is being built for remelting zinc at the rate of 200 tons per day. The loss of zinc by such electric melting is so reduced compared with the old crucible process that an electric furnace installation of this type pays for itself in 3 to 4 months.

John A. Seede, of the General Electric Company, gave an illustrated talk on "Control Equipments for Electric Furnaces." He first reviewed the construction of the best known types of arc, induction and resistance furnaces, describing several furnaces that were developed in the General Electric laboratory for special processes, such as the reduction of tungsten ores.

Arc furnaces require much more intricate control equipment than the induction or resistance types, because fluctuations in the arc or arcs are more likely to

occur, thus causing voltage disturbance in the line, phase unbalancing and other difficulties. The electrodes must therefore be carefully regulated. Control sets have been developed for doing this by hand, automatically, or either, as desired. The manual control includes a set of push buttons for each electrode; pushing one button causes a motor to raise the electrode, pushing the other button causes it to lower, while release of either button stops the motor instantly. The automatic control works through a set of very sensitive relays and regulates very much better than can be done by hand.

C. F. Busse, of the Hoskins Manufacturing Company, described Hoskins wire-wound electric furnaces using high-resistance wires. Although first built for laboratory use, they are now made in quite large sizes also; in fact, up to 100 kilowatts in rating. First they were used chiefly for research work and for smelting expensive or rare metals. The development of nickel-chromium wire was closely associated with the development of these furnaces. They are now being used for a considerable variety of purposes, including heat-treatment of steel, annealing, etc. The carbon-blade and hairpin types of construction were especially described.

Others who discussed the subject were: Mr. Gardner, of the Illinois Steel Company; Mr. Walker, of the Booth-Hall Company; H. M. St. John, Commonwealth Edison Company; Alfred Herz, Public Service Company of Northern Illinois; F. Von Schlegell, Industrial Electric Furnace Company; Mr. Hart, an experienced steel maker; and Messrs. Williams, Baily, Seede and PenDell. Mr. Walker emphasized the mechanical construction of the furnace as the most important feature. Mr. St. John thought the metallurgical characteristics of prime importance. Mr. Herz discussed the need for close regulation of arc furnaces. Mr. Von Schlegell suggested that the purchaser state his metallurgical requirements and ask for a guarantee; this will insure his obtaining the furnace suited to his work. Mr. Hart reviewed some of the history of heat-treatment of steel and pointed out the high quality of product obtained from the electric process using resistance furnaces. Mr. PenDell reviewed the advantages of the electric furnace.

Before the meeting proper, a long motion-picture biographical stretch of Thomas A. Edison was presented by courtesy of the General Electric Company; it dealt chiefly with his early life and his invention of the incandescent lamp in 1879.

SOCIETY FOR ELECTRICAL DEVELOPMENT ENDORSES GOODWIN PLAN.

The directors of the Society for Electrical Development met in New York City, Tuesday, March 5, and adopted resolutions of the Special Committee supporting the basic ideas of the so-called Goodwin Plan. The Society officials were directed to carry out these resolutions. A Nominating Committee and a Special Conference Committee were also appointed. The report of the treasurer showed a balance on hand of $45,000. General Manager Wakeman stated that 86 per cent of the applications for increased rates by central-station companies had been granted.

Among those attending the meeting were Henry L. Doherty, President J. M. Wakeman, General Manager H. J. Smieton, Jr., Secretary and Directors J. E. Montague, W. E. Robertson, Gerard Swope, Earnest McCleary, J. R. Strong, Fred Bissel, J. Robert Crouse, F. M. Feiker and Charles W. Price.

BOSTON CONTRACTORS HOLD ORGANIZATION MEETING.

Goodwin Plan Endorsed and New District Officers Elected.

The organization meeting of the Boston District of the Massachusetts State Association of Electrical Contractors and Dealers was held at the City Club, Boston, on February 14, 1918.

The meeting was called to order by H. A. Holder, acting chairman. A nominating committee was appointed who retired and elected the following members to serve one year on the Executive Committee: C. G. M. Miller, H. M. Lobdell, Guy C. Willis, H. S. Potter, F. L. Barnes, H. A. Holder, and W. St. George.

This committee retired and brought in the names of H. A. Holder, chairman; A. F. Kennedy, secretary, and H. M. Lobdell, treasurer.

The new constitution and by-laws were read and accepted.

James R. Strong of New York gave a very interesting explanation of the proposed organization scheme. He was listened to attentively for an hour by the over one hundred persons present, representing manufacturers, central stations, jobbers and contractors.

Immediately after Mr. Strong's very interesting talk, the chairman introduced William L. Goodwin. Mr. Goodwin explained in detail the Wheatstone bridge system as applied to the manufacturers, jobbers, contractors and central stations, and in the course of his talk he made many telling points that could not fail to convince those present of the feasibility of the plan proposed. He referred in a very flattering way to the progress made in the Massachusetts Association, which compared very favorably to say the least with any of the states who have affiliated with the National Association, who have accepted this plan.

At 6:30, 75 of those present adjourned to the banquet hall and during the meal and after, visitors and others were called upon for remarks.

James R. Strong gave very valuable information regarding the action of the National Executive Committee. Representatives of jobbers and central stations were called upon and their talk was received with wrapped attention.

Mr. Goodwin was again called upon and he told of the many experiences he had in different parts of the country in the formation of this new plan, and had been asked many times by prospective members the question: "What do I get out of this for my money?"

He answered them by referring to the present struggle in Europe for democracy, for a world's democracy, for a country where each could cast a vote for what he thought was right for his country, himself and his family. Men and women were giving money and in many cases the lives of their sons, brothers and fathers, and their own. What do they get out of it? They get the freedom of thought and of action in affairs that are of paramount interest to them and their dependents. You are called upon to give a few paltry dollars that you may have a voice in the conducting of affairs that are of vital interest to your business life, also to things that you should be able to regulate or at least express your ideas concerning them, and by membership in this organization you will be in a position to cast your vote for better conditions, more profit and a more favorable method of doing business.

TO KEEP UTILITIES FROM RAILROADS' FATE.

Country Dependent on Public Service Corporations—Greater Financial Support Needed.

By O. B. Willcox.

The following article on war finance and public utilities, expressing a banker's view on some phases of the report of the Controller of the Currency, was written to The Annalist by O. B. Willcox, Vice-President of Bonbright & Company, Inc.

The Controller of the Currency, Hon. John Skelton Williams, in his report to Congress for 1917, as quoted in The New York Times, has rendered a timely and very necessary service to the nation in forcibly presenting to Congress and the people the facts, not sufficiently recognized, that the decline of the earning capacity of the public utility corporations is a real danger which should stimulate the efforts of Congress and of every patriotic citizen, because, as the Controller says, upon the efficiency and strength of these corporations the country is largely dependent for speed and success in preparing for and prosecuting the war, and the breaking down of these corporations would be a national calamity.

Time and labor and money saving machinery in the United States must offset the high cost of labor, materials, and fuel. Machinery will win the war—time and labor-saving machinery; the same machinery, and nothing else, can protect our trade balances and our gold reserves against tremendous and destructive losses when the strength of all the world will enviously reach out for our accumulated capital.

Our public utility systems save more time, labor, and fuel, and therefore more money, than any machinery in this or any other country. These savings mean more rapid production and lower manufacturing costs; that is why the demands upon the public utilities have been greater than ever before, and that is why we are dependent upon them for speed and success in preparing for and prosecuting the war.

The President, in his latest declaration, says that the achievements of this year, on the one side or the other, must determine the issue of this war, and that the forces that fight for the freedom of men all over the world, as well as our own, depend upon us in an extraordinary and unexpected degree not only for sustenance, but also for materials by which men are to live and fight. This makes clear the extraordinary and unexpected demands on our utility systems; they provide the immediate and ready means, to the limits of their capacity, for speed in production of war materials, and effect notable economies not only in time but in labor and fuels, in these times of their shortage. Unfortunately the capacity of the utility systems is not equal to the insistent demands for their service, as is everywhere apparent.

As the breaking down of these systems would be a national calamity, so their preservation and their expansion is a national duty which must, as the Controller says, "stimulate the efforts of Congress and every patriotic citizen." The danger of the breakdown lies in both the low rates paid for service and the difficulty of providing funds for payment of expansion demanded by the public, and maturing obligations.

With costs of materials used in maintenance of utility properties increased from 180 per cent to 400 per cent, with costs of fuel more than doubled and costs of labor largely increased, it is self-evident that rates fixed for a bare return on depreciated valuation, reckoned on costs of operating in normal times, must be substantially increased, and in these times, when the government financing monopolizes investment markets, it is clear that extraordinary means must be provided to secure to the utilities the large sums they need for expansion as well as for maturing security issues.

The breaking down of the utility system would be, as the Controller has warned us, a national calamity. The nation must therefore prevent break down by remedying the conditions which have created the danger.

First—It is clearly the duty of the officials of every utility to make applications to the proper regulating body for adequate increases in rates for service, and it is believed, as the Controller says in his report, that the State Commissions and municipal authorities will treat these applications with "forbearance and consideration," and permit charges for service which "will keep in them the breath of solvency, protect their owners against unjust loss, and give them a basis for credit on which they may obtain the funds with which to meet the strain put on them by the Government needs."

Second—New capital for maturities and for the expansion and enlarged capacity required in the nation's and the public's interest can be procured from the investing public now with the greatest difficulty, and only at very high rates, if at all, and only by companies whose credit is of the first class through a surplus of earnings above operating cost and fixed charges. High rates as a basis for credit cannot be secured and put in effect promptly enough to meet necessities. The new capital must be provided promptly, to be effective, and without awaiting the usual processes of corporate financing.

The Controller has pointed out the dangers and the necessity for higher rates, and has recommended Congressional action to provide financial aid to insure adequate service.

Secretary McAdoo, with keen vision of the country's need, has disclosed both the present necessity for the capital required by the utilities as well as other essential industries, and the remedy, in the "War Finance Corporation" which he has proposed in his recommendations to Congress. The bill for the organization of this exigent government function gives necessarily broad powers and wide discretion to its directors, as its critics have pointed out. To forfend grave dangers great powers must be exercised, and for their functioning must be delegated.

To quote again the President's last declaration, we must win the war, and "the achievements of this year on the one side or the other must determine the issue." If we err in our judgment let it be by too great provision for our needs rather than too little.

ST. LOUIS JOVIANS HEAR ADDRESS ON BUILDING OF A CANTONMENT.

In his address before the St. Louis Jovian League February 19 Major John R. Fordyce, Engineers' Reserve Corps, constructing quartermaster in charge of the building of Camp Pike, near Little Rock, Ark., showed conclusively the efficiency and dispatch with which the work was completed.

Within two and one-half months after the order was given by the War Department the cantonment was ready to receive troops as fast as they could be transported to it; graded streets had been made, water and sewer systems installed and the camp was electrified.

The original order was given by the War Department June 14, the site and arrangements for construction were completed and approved June 30, on September 5 the first detachment of troops arrived, and from that time the work of construction was kept ahead of troop arrivals. There are 1600 buildings in the cantonment.

AN OLD-TIME NATIONAL ELECTRICAL SOCIETY WITH HEADQUARTERS IN CHICAGO.

By William E. Keily.

Forty years ago Chicago was the headquarters of a national electrical society, probably the only organization of the kind in existence in this country at that time. This was the American Electrical Society, organized in Chicago in 1874, and which was in existence as late as 1879 but appears to have petered out in 1880 or 1881. The oldest of the existing electrical societies is probably the New York Electrical Society, which was founded in 1881. The American Institute of Electrical Engineers was organized in 1884 and the National Electric Light Association and the Association of Edison Illuminating Companies in 1885. The American Electrical Society, now almost forgotten, was thus the predecessor of all these, and no doubt the pioneer national electrical society of the United States. In the course of some recent historical researches, the writer, with the kind assistance of Ralph W. Pope, has procured some information about this old-time organization, and he has prepared the present article, thinking that a brief account of the society may be of interest to the electrical public.

By the constitution it was provided that the headquarters of the society should be in Chicago. The organization was national in scope, however, and in course of time auxiliary or local societies were formed in Chicago, Cleveland, Toledo and Cincinnati. As officially stated, the object of the society was "the interchange of knowledge and the professional improvement of its members, the advancement of electrical and telegraphic science, and the establishment of a central point of reference." The society was organized in Chicago on October 21, 1874. All the annual meetings were held in Chicago. The president of this society during its active career was Gen. Anson Stager. From 1870 to 1885 Gen. Stager was the great figure in the electrical industries of Chicago. He was a man of fine business and executive ability. He was vice-president of the Western Union Telegraph Company and general superintendent of the central district of the same company, with headquarters in Chicago. In 1872, in partnership with E. M. Barton and Elisha Gray, he formed the Western Electric Manufacturing Company of Chicago, the predecessor of the Western Electric Company, Incorporated, of today. Gen. Stager was president of this company from 1872 until it was reorganized in 1879 as the Western Electric Company, and he remained as president of the latter company until his death in 1885. Gen. Stager was also the first president of the Chicago Telephone Company, and he was likewise the president and principal figure in the Western Edison Light Company, which was chartered on May 25, 1882. This company was succeeded by the Chicago Edison Company, and this by the present Commonwealth Edison Company, formed as the result of the efforts of Samuel Insull, its president in 1907.

Among the active members of the society, in addition to Gen. Stager, were John P. Barrett, George H. Bliss, E. M. Barton, E. B. Chandler, R. C. Clowry, S. D. Field, Elisha Gray, C. H. Haskins, Charles H. Wilson, G. A. Hamilton, F. W. Jones, M. G. Kellogg, Franklin L. Pope, C. H. Summers, William Henry Smith, E. P. Warner and A. J. Earling.

Among the honorary members were men of prominence, including Cyrus W. Field, A. B. Cornell, T. C. Mendenhall, Joseph Henry, Peter Cooper, Moses G. Farmer, William Orton, Sir Hugh Allan of Montreal, Sir William Thomson (afterward Lord Kelvin) of Glasgow, and Latimer Clark of London. The society published a handsomely printed *Journal*, appearing annually, four thin volumes of which are extant. In these proceedings are preserved a number of papers of historical importance. One by Elisha Gray was "On the Transmission of Musical Tones Telegraphically," being an address given before the society on March 17, 1875, and published in the first number of the *Journal*.

Proceedings of the Society.

In No. 2 of the *Journal* there was an article by Moses G. Farmer bearing the rather curious title "The Wheatstone's Bridge."

On October 13, 1877, Joseph Henry wrote from the Smithsonian Institution in Washington approving the object of the society, and asking for information relating to the phenomena of thunderstorms, with accounts of two thunderstorms transmitted for permanent record in a scientific publication.

An interesting letter to the *Journal* was that from Moses G. Farmer, dated Torpedo Station, Newport, R. I., October 13, 1877. The writer expressed regret at not being able to attend the annual meeting of that year and then proceeded: "But what if I am not there! You will only miss a neophyte, just learning his A B C's." Mr. Farmer described the electric lighting of the Torpedo Station, remarking that the Wilde, Siemens, Serrin, Wallace and Farmer electric lamps were installed. He then went on: "As power can be furnished at less than six cents per hour per horsepower and carbon at less than five cents per inch, you will readily see that the subject of electrical lighting is one of the coming events that casts its shadow deeply and beautiful all around." And again: "The subject of electric light has occupied very much of my attention during the last nineteen years." The writer also spoke with enthusiasm of the invention of the speaking telephone, mentioning the work of Bell, Gray, Edison, Dolbear and A. G. Holcomb.

Another prominent contributor to the *Journal* was Charles F. Brush, M. E., who wrote an article on "Dynamo-Electric Machines," dated at Cleveland, December 11, 1878, (At that time Chicago had two Brush arc lamps in service.) Among other things, Mr. Brush said: "The field for electric lighting is opening up more widely from day to day, but it still seems confined, to a great extent, to such places as are of considerable size, and require a strong light. I have made some quite exhaustive experiments in the direction of lighting by incandescence, but with no fully satisfactory results in the point of economy. I judge that from a given current nearly forty times as much light may be obtained by the use of the voltaic arc between carbon points as could be obtained by any known method from incandescent carbon or platinum."

One of the most elaborate articles contributed to the records of the Society was a monograph, with portrait, on "The Life and Work of Joseph Henry," written by Franklin L. Pope and published in the 1879 volume of the *Journal*. In relation to the delivery of this paper, Mr. Ralph W. Pope contributes the following: "I have a vivid recollection of the date, as my father died suddenly at my house on December 12, 1878, while my late brother, Franklin L., was en route to Chicago, having prepared for that meeting a paper on 'The Life and Work of Joseph Henry.' Through the personal efforts of the late F. W. Jones my tele-

gram was delivered on the train and Franklin returned direct to Great Barrington, Mass., in time for the funeral."

At the annual meeting of 1877 the Society recommended the appointment of Charles H. Haskins of Milwaukee as the representative of the telegraphic interests of the United States at the Paris International Exposition of 1878. The records do not show whether this appointment was made, but at any rate Mr. Haskins went to Paris and described the exposition at a subsequent meeting.

The late S. P. Langley, who afterward became a pioneer in the study of aviation, read a paper before the Society on December 12, 1878, on "Electric Time Service."

Prof. H. S. Carhart, then of Northwestern University, contributed an article, dated October, 1878, on "Some Observations in Thermal Electricity."

Several references to the work of Thomas A. Edison are made in the *Journal*. In the first number there was a brief description of some of his experiments of November, 1875. Mr. Edison sent a letter regretting his inability to attend the annual meeting of 1877. The minutes of the annual meeting of December 11, 1878, contained this brief reference: "The subject of the electric light was now introduced, and Mr. G. H. Bliss illustrated and explained Edison's method." A newspaper account of the day says that the speaker entered into quite an elaborate description of Edison's light, illustrating his remarks with blackboard diagrams. This was the George H. Bliss who became the Chicago agent of the Edison Electric Light Company of New York in 1881 and who next year became the general superintendent of the recently organized Western Edison Light Company. Mr. Bliss died in 1900.

The decline and fall of the Society are not marked in the official record. The organization did not live long enough to witness the rise of the electric light and power industry to great proportions, but it had an honorable career and has left four volumes of its proceedings which contain not a little material of historical value.

ARTHUR WILLIAMS ADDRESSES NEW YORK LEAGUE.

Patriotic Activities Urged by Prominent Speakers Before Jovians on February 6.

The New York Jovian League held an enthusiastic meeting at Stewart's restaurant, New York City, on February 6, 1918. James M. Wakeman, who presided, and Arthur Williams, New York food administrator, were the principal speakers.

The chairman opened the meeting by reading a letter from Ell C. Bennett, in which it was announced that New York City was League No. 28 of the local leagues under the new constitution. Geo. W. Pelz, First Tribune, then read the names of the men rejuvenated at the January meeting.

Mr. Wakeman spoke on the subject of War Savings Stamps and emphasized this as the one method of financing the war. He made these points:

We save by not using, and everything saved is so much more food, clothing, shoes, blankets for the boys in the service.

The money saved is turned over to the Government to use in winning the war, with interest.

When the war is over we get this money back for our own use again.

We will have learned thrift, our people will have acquired the habit of saving to invest, and that will make us a better nation than we were before.

We will have the satisfaction of knowing that we did something that helped to make this country, of which we are all so fond and to which we are all devoted, both prosperous and victorious.

George Patterson, of Stanley & Patterson, showed specifically how Jovians could promote the sale of War Savings Stamps. His suggestions were received with enthusiasm. Over 150 W. S. S. were sold at the meeting, and the Advisory Committee voted to send copies of Mr. Patterson's remarks to each member of the local league.

Arthur Williams, food administrator for New York City, who was introduced by the chairman, emphasized the need of each man taking the responsibility of the war upon himself, and after an eloquent address suggested three ways in which Jovians could individually promote and carry out the plans of the Food Administration in Washington: One, by observing the "less" days at restaurants and hotels, by refusing to eat at places which did not observe such days; two, by observing the suggested program of the Administration in their homes, having at least one wheatless meal a day; third, by appointing a war ration according to the Hoover plan, and by promoting the use of this war ration in every home in the country. Mr. Williams was enthusiastically received, and it was resolved to promote in every way possible the wider acceptance of his program.

James R. Pollock, chairman of the Advisory Committee, reported that two meetings of his committee had been held, and that the work of the league is actively under way.

CENTRAL-STATION SERVICE AS A FUEL SAVER.

New York Commission Considering Elimination of Small Isolated Plants for Period of War.

The Public Service Commission for the First District, New York, is now considering whether, in the interest of the conservation of coal during war times, private electric plants should not be closed down and current obtained by all consumers from central stations, such as those operated by the big electrical companies. Attention of the Commission to a possible need for such action has been called by Albert H. Wiggin, Fuel Administrator, in a recent circular letter addressed particularly to private-plant owners and operators. The Fuel Administration in Washington is said to be very deeply interested in the plans and believes that a very considerable amount of coal can be saved. The United States Fuel Administrator has been represented at the hearings so far held by the Commission. Officials of electric companies have testified to their belief that fully 500,000, tons of coal might annually be saved and possibly a great deal more by eliminating, for the period of the war at least, the operation of private electrical plants, such as those which furnish one building or a small group of adjoining buildings with current for power or lighting purposes or both.

Electrical Inspectors Endorse Safety Code.—The Western Association of Electrical Inspectors at its annual convention on January 29-31 at Memphis, Tenn., passed a resolution endorsing the National Electrical Safety Code and urging its adoption for trial use by authorities having jurisdiction.

Commercial

Motor Drive in Crane Factory—Advantages of Central-Station Service for Clay Plants—Other Commercial News

MOTOR DRIVE IN ELECTRIC CRANE FACTORY.

Shaw Electric Crane Company Uses Central-Station Service Throughout.

The Shaw Electric Crane Company, Muskegon, Mich., which last year was using direct-current motors of 920 horsepower, and alternating-current motors amounting to 180 horsepower, lately installed additional alternating-current motors of 180 horsepower. Central-station alternating-current energy is received by the transformers at 6600 volts. Power required for the direct-current motors is stepped down to 150 volts and passed to a Westinghouse 300-kilowatt, 3-phase, rotary converter, running at 412 revolutions, by which alternating is changed to direct current, this being used for motors at 220 volts and for lights at 110. Current required for the alternating-current motors is stepped down to 440 volts, and distributed from the power panels on the switchboard.

Alternating-current motors are employed mostly for running air compressors and shop machines. One compressor of 350 cubic foot capacity is driven by a belt-connected 75-horsepower motor, the air in this case operating 20 air hoists which are used in lifting heavy material to and from machine tools, by means of jib cranes. A Dietrick & Harvy planer is run by a 25-horsepower motor, connected by shaft coupling, and having automatic control. The other alternating-current motors comprise 10 and 15-horsepower machines, driving tools in groups through line shafting. All large machine tools are operated by individual motors, mostly direct-connected.

The shops are equipped with seven electric traveling cranes of an average span of 46 feet, except two of 15 and 25 feet, respectively. This crane equipment comprises one of 25 tons capacity, one of 20 tons, two of 10 tons, one of 7½ tons, one of 5 tons and one of 2 tons. All are equipped with direct-current hoist and bridge motors.

The company builds a special type of direct-current motor adapted to crane operating, but does not build alternating-current motors. In the manufacture of electric cranes, the company turns out those fully equipped for both direct and alternating-current motors, with controllers.

The shop equipment includes electric heating furnaces and a spot welder used in sheet-metal work. A machine for measuring and cutting wires at various lengths is operated by an electric motor. By this means an entire roll of wire may be used without hand work.

All arc lamps were recently taken out, and in lieu thereof 140 Mazda lamps of 100 to 500 watts capacity were installed in shops and yards. Besides, each shop machine is directly lighted by a 40-watt Mazda lamp.

The plant is equipped with two 150-horsepower Stirling boilers and one of 100 horsepower for heating, steam-hammer power and varnish baking.

CENTRAL-STATION SERVICE FOR CLAY-WORKING PLANTS.

Advantage of Motor Drive and Data on Characteristics of Motors for This Service.

With the approach of the open season it may be of interest to point out briefly some of the more important advantages of electricity for clay-working plants, with special reference to the use of central-station service.

Flexibility of Electric Drive.

With electric drive the various departments of the plant can be located and arranged to the best advantage for operating without the limitation of arrangements imposed by central engine drive with the accompanying belt connections to the various departments.

With central steam engine drive there must be used long line shafts and belts. If it is desired to operate only one machine or department in the plant, all of this shafting and belting must be run, which means a large friction load. In such cases this power lost in friction may equal or exceed that used in doing useful work. Not only is the cost of such waste power a big item, but the wear on belts, shafts, and bearings is considerable. Where there is fine clay dust in the air this wear is very great. The dust collects on the belts, pulleys, and works into the hanger bearings, causing belt slippage, which means decreased output and belts must be run very tight. With individual motor drive made economically possible by using electric motors, energy is required only when useful work is being done. The control of any one machine is conveniently at the hand of the operator, and the machine can be started and stopped at will. There is no cost for power after the machine is shut down, as would occur were long lines of belting and shafting used.

In plants where there is excessive clay dust in the air electric motors can be direct-connected or geared to the driven machines, doing away with belt trouble entirely.

Greater Assurance of Continuous Operation.

When the various machines or departments are operated by means of individual motors there is a greater assurance of continuous operation as compared with central engine drive, in which case engine trouble means the shutdown of the whole plant. Motors maintain a practically constant speed throughout their operating range, which results in increased production over the plant driven by a single steam engine where the speed varies not only with the boiler pressure but also with the variation in load.

Electric motors can be placed wherever convenient on the ceiling, on a side wall, on the floor, or right on the machine to be driven, and the machines can be located to best serve the logical sequence of operations.

The flexibility of a motor system is also of the greatest advantage, since frequent changes in the positions of the machines and additions to the equipment are often necessary. When motors are used they can be shifted with ease. All that is necessary is to run feeders to the new location. New machines can easily be added to any part of the plant.

Due to the fact that motors can be applied at the closest position to the driven machines, belts, gears, etc., are reduced to a minimum. The absence of many shafts, belts, and pulleys means that the plant will be lighter and cleaner, allowing more and better work to be done.

Fuses or circuit-breakers are installed in the motor circuit as a protection against heavy overloads such as might occur if a machine became clogged with clay. In such a case the current is cut off from the motor, and it stops, preventing any damage to it or the driven machine. The possibility of a shutdown due to a machine breaking is thus reduced to a minimum.

Two Main Types of Motors.

There are two main types of polyphase alternating-current motors used for manufacturing purposes—the synchronous motor and the induction motor. The synchronous motor is often used to drive machines requiring, say, 200 horsepower or more where the starting conditions are light, where the starting current is not objectionable, and where only one speed of operation is desired. If overloaded more than about 50 per cent, or the voltage at the motor terminals allowed to drop more than about 10 per cent, a synchronous motor will stop.

The induction motor is used to drive such machines as required in clay-working plants, so we can confine our remarks to this type of motor.

The induction motor consists essentially of a stationary part, at either end of which is a bracket supporting a bearing. The shaft which rotates in these bearings has mounted on it a rotating member. The clearance between the rotating and stationary parts is small, being less than 1/16 inch in a 50-h. p. motor. There is no electrical connection between rotating and stationary parts, and there are few parts to get out of repair. The induction motor is the most rugged type of electric motor made.

There are two main types of polyphase induction motors—that having a squirrel-cage rotor and that having a wound rotor. They are commonly called the squirrel-cage motor and the wound rotor or slip-ring motor. The rotor, as the name implies, is the revolving part. The stator, or stationary part, is practically the same in both types of motor.

Squirrel-Cage Motor Generally Preferable.

The squirrel-cage rotor derives its name from the fact that its winding resembles in appearance the rotating wheel found in a squirrel's cage. The winding consists of two heavy copper or alloy rings, which are held in place by bars, usually made of copper, which span the space between the rings at regular intervals. The ends of these bars may be riveted, bolted, or welded to the two rings. The rotor of a wound rotor motor has on it a winding similar to the stationary part, consisting of many turns of insulated copper wire. The leads from the different phases of the winding are brought out to three collector rings, on which slide the carbon brushes which carry the rotor current to the external resistance which is used with this type of motor. The collector rings are often called slip rings, from which comes the name slip-ring motor. The squirrel-cage rotor is more rugged than the wound rotor, and there are less parts to get out of repair. The squirrel-cage rotor is practically indestructible on motors of the latest type where the rotor bars are welded to the two rings, which are called resistance rings. A squirrel-cage motor is considerably cheaper to buy than a wound-rotor motor. So, everything considered, the squirrel-cage motor should be chosen rather than the wound rotor or slip-ring motor, except in a few applications where the latter is particularly suitable.

Where it is desired to have a motor operate at a number of different speeds the wound-rotor motor is used. It is very often used where the torque required to start a load is very great. This is particularly true where the power plant supplying the current is of limited capacity, as less current will be drawn from the line at start than were a squirrel-cage motor used. The wound-rotor motor in a clay plant is sometimes used to drive the dry pans, pug mills, and auger machines. When squirrel-cage motors are used with these machines motors with large starting torque should be applied, unless there is a clutch between the motors and the machines. Wound-rotor motors should not be used where there is stone dust in the air unless the collector rings are closed in, as such dust, getting between the brushes and rings, rapidly wears the collector rings. Squirrel-cage motors can be supplied suitable for driving all the machines used in clay-working plants.

Characteristics of Induction Motors.

A few of the characteristics of an induction motor which may be of interest are as follows:

1. It will carry a load for short periods of two to two and a half times full load without injuring the motor and without the motor stopping.
2. The speed of the motor will be practically constant from approximately 50 per cent load to 50 per cent overload.
3. The motor will start a load where the starting torque required is considerably greater than the running torque. The motor can be designed with a starting torque up to two and a half times the running torque where desired for heavy starting service.
4. The current taken by the motor when starting will be approximately two to five times that required when running. It depends on the load to be started.
5. If the voltage at the motor terminals drops below normal the starting torque will decrease as the square of the terminal voltage divided by the normal voltage.

In applying electric motors to clay-working machinery the following severe conditions must be kept in mind:

1. Severe starting requirements, due to the inertia of the driven machinery and to material in the machinery hardening when at rest.
2. Severe overloads, due to irregular feed of material.
3. Dusty atmosphere about plants and presence of dampness, causing collected dust on the motors to become cemented to the windings and interfering with ventilation.
4. The use of gears of large pitch and high pitch-line speeds resulting in severe vibrations.

Good service is obtained with these conditions only when careful consideration is given to the application to each individual machine. The motors in clay plants should have generous starting and running characteristics, the bearings made dust-proof, and the windings

impregnated to withstand moisture. The motors should be carefully aligned with the driven machines. The feeders to the motors should be of ample size to carry the current, bearing in mind that motors which drive machines hard to start will draw much heavier currents than those driving machines easy to start. If the feeders are too small the terminal voltage will be lowered, with consequent decrease in starting torque.

To provide for the severe starting and running conditions there has been a tendency to select motors larger than necessary. The result of the low load factor caused thereby is low power factor and low efficiency of the individual motors. On account of low efficiency the cost of electric power will be greater. This cost will still be increased if there is a penalty for low power-factor. The best plan is to consult the manufacturer who can supply a motor just large enough to do the required work, and with large starting torque where such is required. In case of machines hard to start, a standard squirrel motor can be used in combination with a friction clutch and the motor started without load. Friction clutches, however, are subject to wear, and should be avoided wherever possible.

Consideration must be given as to whether group or individual drive of machinery would be better. For plants with storage facilities between the various departments and the machinery scattered individual drive will usually be better, while for plants with all machinery inter-dependent and grouped group drive will be better.

The following are usual drives employed for the more common machinery found in clay plants:

1. The conveyor from the storage bin is usually belted from the motor driving the crusher or dry pan.

2. Crushers are usually belted to the motors. Motors with gods starting and pull-out torques are required with all kinds of crushing machinery.

3. Dry pans are usually driven by motors geared to the dry pan shafts. The vibrations of these machines are severe, and the motor shafts should be supported by outboard bearings. An improved arrangement is to have flexible couplings between the gearing and the motors, as this prevents the transmission of vibrations to the motors to a large extent.

4. The pug mill and auger machines may be driven by motors, either belted or geared to them. Because of the large pitch of the gears of these machines considerable vibration results, and flexible couplings should be used if the motors are geared. These machines are sometimes stopped full of material, which hardens if the shut-down is of an appreciable length, and, if clutches are not provided, the starting requirements of the motors are severe. For such installations wound-rotor motors are advisable.

5. The cutters, represses, elevators, and conveyors between the various machines require little power, and may be driven from the motors driving the machines upon whose operation they are dependent, or individually by small motors.

MINNEAPOLIS COMPANY ADDS 22,000 HORSEPOWER IN NEW BUSINESS.

The present demands for power service upon central electric stations are reflected by the situation of the Northern States Power Company in the Minneapolis-Saint Paul district, where upwards of 22,000 horsepower in industrial motors already contracted for to be added to the Company's lines within the next few months. With the possible exception of service to two munitions factories, all of this power business is of a permanent character and will be used for driving industries fully as necessary in peace as in war. Included in these contracts are those for fourteen flour mills and four elevators and grain handling plants, railroad shops and terminals, a hospital, a large farm implement factory, dredging and filling operations for the construction of a big meat packing plant and 1500 additional horsepower for pumping the municipal water supply of Minneapolis. Although the Twin Cities are far removed from the seaboard, one of the new power contracts will assist in the shipbuilding program as it will serve a boiler factory filling a contract with the fleet corporation.

"Virtually all of this business," says H. E. Young, sales manager, "will come on our lines at the time when our water powers will be at maximum strength."

CATERING TO CUSTOMERS' REQUIREMENTS ENTAILS MUCH WORK.

The Commonwealth Edison Company recently issued a statement that emphasizes in forcible manner the amount of work attached to the installation of meters, and customers' service generally. The following shows the immense amount of work involved and accomplished by the Customers' Service and Repair Department during 1917:

Number of meters installed	52,352
Number of meters exchanged	35,679
Number of meters reconnected	105,499
Number of meters removed	16,770
Number of misc. meter calls	21,799
Sub total	232,099
Number of repair calls	283,386
Number of heating device repairs	73,145
Sub total	356,531
Total calls made	588,630
Total in 1916	573,569
Increase over 1916	15,061

During the year this same department, which constitutes the last link between central station service and the customer's service switch, maintained on the customers' premises an average of 47,000 rental fixtures, 2500 street posts, 4010 signs, 1528 municipal street arc lights, and 1783 commercial arcs.

INDIANA UTILITIES MUST MAINTAIN DEPRECIATION RESERVE.

The Indiana Public Service Commission has issued a general warning to utility companies who maintain incorrect methods of accounting, as follows:

Frequently a utility will fail to maintain a depreciation fund and while permitting its original property to depreciate will make extensions or additions out of so-called surplus income and then seek to capitalize their extensions and improvements, when the moneys so expended should have been set aside as a depreciation reserve, which legally is not susceptible of capitalization. This practice by utilities of setting up a fictitious book depreciation and ignoring proper depreciation debits against this account can only result in the Commission taking such steps as will effectuate a complete and substantial obedience to the specific depreciation provisions of the act. In cases where the practice has continued the Commission will naturally, for rate-making purposes, make such deductions from operating expenses as may be found proper and sufficient to cover a reasonable depreciation reserve.

Operating

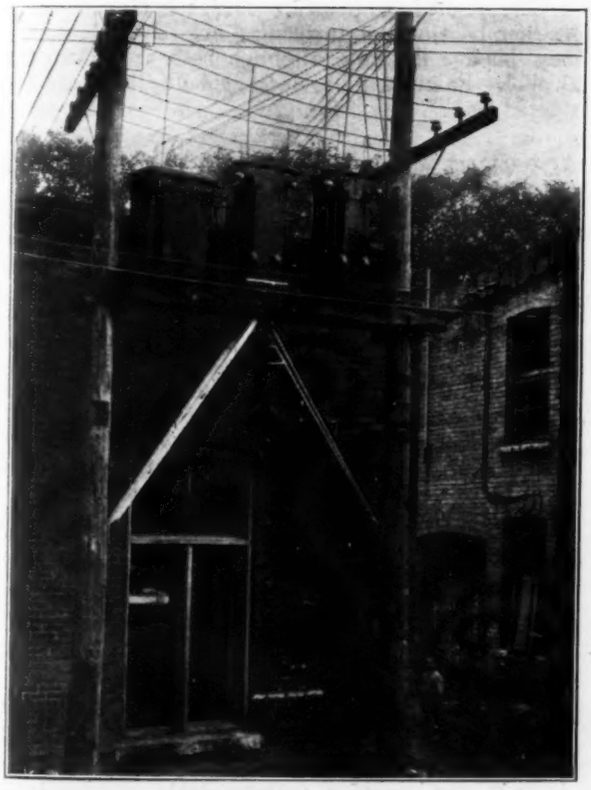
Wrecked Transformer Bank—Fatal Accident—Feed-Water Economy—Smoke Problem—Graphic Meter Causes Saving

OIL LEAKAGE CAUSES TRANSFORMER FAILURE.

Syphoning Transformer Leads to Destruction of Complete Installation.

By Francis Miller.

The importance of having distributing transformers, all oil-immersed apparatus so far as that goes, properly filled with oil and with oil maintained at all times in proper condition might appear so obvious as to be hardly worth mentioning. However, in one case failure to appreciate this fact resulted in far-reaching consequences in a way that deserves mentioning. The following experience bears out the recommendations appearing in the article entitled "Some Phases of Protecting Pole Type Transformers" by S. F. Erickson, which appeared on page 187, February 2 issue of the Electrical Review, and thus serves to emphasize the importance of attending to one factor of installation and maintenance that often receives far less consideration than it should.



Transformer Bank Wrecked Because One Unit Syphoned Its Oil Down Secondary Leads.

The installation in question consisted of three transformers resting upon a platform, which in turn was mounted upon two poles, as seen in the photograph. These transformers served the adjacent factory and at high load factor since the factory was working two shifts of nine hours each. Moreover, the transformers during the active working period carried about 10 per cent overload. The heating of the units will be understood to be higher than is usually the case for transformers used for distribution, hence it was more important than ever that the oil be in good condition and up to full level.

In the present instance one transformer was destroyed and damage, if not destruction, narrowly averted to the remaining two. After the plant had shut down, the transformer on the left-hand side caught fire. In some way the fire spread and set the cross-arms supporting the transformers on fire. When this had burnt sufficiently to weaken the strength of the platform, the transformer fell to the ground. Part of the left-hand pole was also burnt, necessitating removal of the remaining two transformers and erection of a new platform.

The incident, apart from being serious and expensive, was peculiar. The apparent cause of the fire was an arc that had started in the transformer above the oil level, which was presumably low. The secondary leads had syphoned oil which had lowered the oil level and permitted the oil to trickle down the platform floor. It is presumed the fire had in some way followed down the oil-soaked leads to the wooden platform, since the leads were burnt bare of insulation. It was fortunate that the galvanized iron braces had been installed, as otherwise all three transformers would have been lost.

The above incident emphasizes the importance of preventing oil from syphoning on the score of fire hazards as well as reduction of transformer capacity, whilst reduced oil level makes a winding more susceptible to attack from lightning.

FALLEN WIRE CAUSES TWO FATALITIES.

In Alabama two men were recently electrocuted when they stepped into a pool of water formed by a heavy rainstorm into which a broken 11,000-volt conductor had fallen. The men had crossed a spur track of an electric car line and stepped from the cinder ballast under the track into the puddle caused by rainfall. Immediately they came into contact with the water they fell unconscious due to electric shock.

During the afternoon a heavy wind and rain storm had occurred. A lightning-arrester house beside the car track, measuring twelve feet square and used to protect the 11,000-volt line, had been blown off by the wind. In falling it broke one of the 11,000-volt conductors entering the arrester house, and it was the loose end of this conductor that lying on the earth caused the two fatalities.

APPROXIMATE METHOD OF CALCULATING ECONOMY OF FEED-WATER HEATER.

By W. F. Schaphorst.

While the value of the feed-water heater is understood in a general way, the actual saving in coal, or increase of boiler capacity, does not appear to be appreciated by many. The following may serve to show the effect of a feed-water heater upon coal economy, and the accompanying chart will be found useful for determining similar cases, simply and with reasonable accuracy.

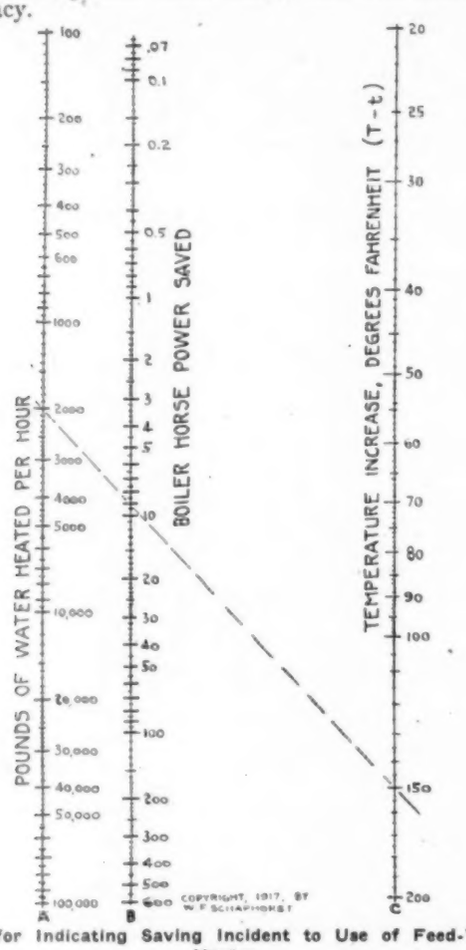


Chart for Indicating Saving Incident to Use of Feed-Water Heater.

This chart contains three columns, the first stating the pounds of water heated per hour, the second the boiler horsepower saved by use of feed-water heater, and the third the increase in feed-water temperature due to the heater.

Suppose 2000 pounds of water are used per hour, and further, that the feed-water heater heats this water 150 degrees Fahrenheit. It is desired to determine the capacity saved, or increased, expressed as boiler horsepower, by the use of a feed-water heater. It is a simple matter to convert this value to pounds of coal if required.

Connect the position marked 2000 on column A with the position marked 150 on column C to the right-hand side by means of a rule or straight edge. Referring to the intermediate column marked B it will be found that the diagonal line crosses it at the position equivalent to nine. This column is that representing boiler horsepower saved. The saving incident to increasing the feed-water temperature 150 degrees Fahrenheit is 9 boiler horsepower, or expressed differently, the capacity of the plant or boiler has been increased by this amount. It is, of course, a comparatively simple matter to convert the value found, namely, boiler horsepower saved, to pounds of coal or dollars for any given plant.

While the above chart indicates the saving in fuel or increase of available capacity due to heating the feed-water with heat that otherwise would be wasted, there is another saving due the use of feed-water heaters that is not shown here. That is on account of its water-treating properties. Heating the feed-water removes some of the impurities, and in this way enables a boiler to maintain higher efficiency than otherwise, and also with somewhat less likelihood of damaged tubes and high flue-gas temperature at the higher ratings. This saving is a very real one, although not readily stated in dollars and cents.

CHOOSING PAINT FOR TAPED JOINTS.

In choosing a paint for taped joints one using a quick-drying solvent will usually be preferable to one using a solvent of slower-drying qualities, as this latter will have a tendency to soak through the taped joint to the rubber beneath, attacking it. The paint should be flexible, and should neither crack nor peel, nor affect the adhesiveness of the tape. A paint proof against acids, alkalies and moisture will give best results for service outdoors, and in the presence of fumes in breweries and similar installations.

The base of the paint or varnish is also important. Neither benzine nor turpentine are advisable as they may damage the tape, although both are better than alcohol. Paints with a black asphaltic base are considered best.

SOLVING A PROBLEM IN SMOKE ABATEMENT.

Settling Chamber Succeeds in Catching Flue Gas Dust Where Other Methods Failed.

In a small eastern steam plant using small-sized anthracite coal dredged from the Susquehanna River considerable smoke nuisance was caused. One characteristic of this coal was that small, flaky particles of almost pure carbon were given off on heating. These, carried up the stack by the draft, polluted the atmosphere, covered the boiler heating surfaces with dirt, and caused nuisance and complaint generally.

Reduction of this nuisance was first tried by mixing soft or bituminous coal with the river coal, but without success. Screens were then inserted at base of the second pass of the boiler, but these soon became clogged up, choked the draft and interfered with performance generally. A dust catcher was next erected on one of the stacks, the idea being to provide an increased space which would result in reduced velocity of the flue gases, and by means of baffles interrupt the passage of the soot flakes up the stack. Even this did not stop the rush of particles into the atmosphere, while it soon interfered with the draft.

Abatement of the dust nuisance finally came about after the steel stack had been replaced by one of concrete. The breeching entered this stack at a point about 40 feet above the base of the chimney. The base, as is usually the case with concrete chimneys, had large ground area and there was thus quite a

spacious chamber below the breeching. The reason this stack solved the problem of escaping flue gas dust and carbonaceous matter was that while the particles left the comparatively restricted breeching at high velocity, the velocity in the large stack of large diameter dropped, until as the particles rose in the stack their weight was overcome by the laws of gravity and the particles would fall into the settling chamber at the base of the stack. The amount of flue gas dust thus captured by the settling chamber at the base of the stack can be appreciated when it is stated that the settling chamber, which was 17 feet in diameter, was found to have been filled to a height of more than 30 feet with dust after only one month's operation.

GRAPHIC RECORDING METER SAVES THOUSANDS OF DOLLARS.

In the management of any factory, plant or business it is necessary to have accurate information in readily interpretable form as to performance if efficiency and economy are to obtain. These records should preferably be available in graphic form that the facts may be easily grasped. Anyone can read a graph or picture whereas figures and tables of figures are not so easily grasped and as often as not may tend to mask the important underlying facts. In any case, figures are never as quickly interpreted as graphic representations. The graphic recording meter has long been used as a means of obtaining continuous graphic representation of factory production, station performance, and various other phenomena by the efficiency and operating engineer for industrial and utility management.

The accompanying chart taken from an industrial plant with its own power station is of interest for several reasons. Firstly, the use of this instrument enabled a saving in investment of $15,000 and a saving in operating expenses of $1000 annually. Secondly, it gives a graphic representation of the day's work, showing how the rate of work starts to gradually decrease about the middle of the morning and continues doing so until the noon lunch period. The wisdom of working so that the operation of air compressor and crane do not coincide is also seen, as when they do a severe peak occurs, which may be expected to interfere with voltage regulation, overloads the equipment 100 per cent and will add to the cost of energy if purchased from central-station service on a maximum demand basis. This can be better seen by referring to 10:30, at which time crane and compressor were operating together, causing a peak of almost 100 per cent above full load.

The graphic recording meter, the record of which is shown, was installed at the private plant of an industrial concern with a view to determining existing load and what additional generating capacity would be required to care for it. The record shows that additional capacity was needed to care for the peaks rather than average load. On the basis of the records from this meter it was decided to obtain central-station energy instead of increasing the capacity of the private plant. By doing so a saving of $15,000 initial investment was made. A saving of $1000 annually in operating expenses was also effected, it was estimated, with coal at pre-war prices, and interest on the investment and depreciation both at 6 per cent.

This instance, one of many, indicates the importance of proper and complete records, thorough investigation as to conditions before spending money, and, lastly, that graphic recording meters are a good investment wherever a continuous record is required, whether continually or only occasionally.

CHICAGO UTILITY SHOWS INCREASED OUTPUT.

Data now available indicate that the output and likewise the load factor of the Commonwealth Edison Company showed an improvement during 1917 over the previous year. A comparison of the maximum load in kilowatts and maximum day's output in kilowatt-hours during the winters of 1916 and 1917 are as follows:

MAXIMUM LOAD KILOWATTS.

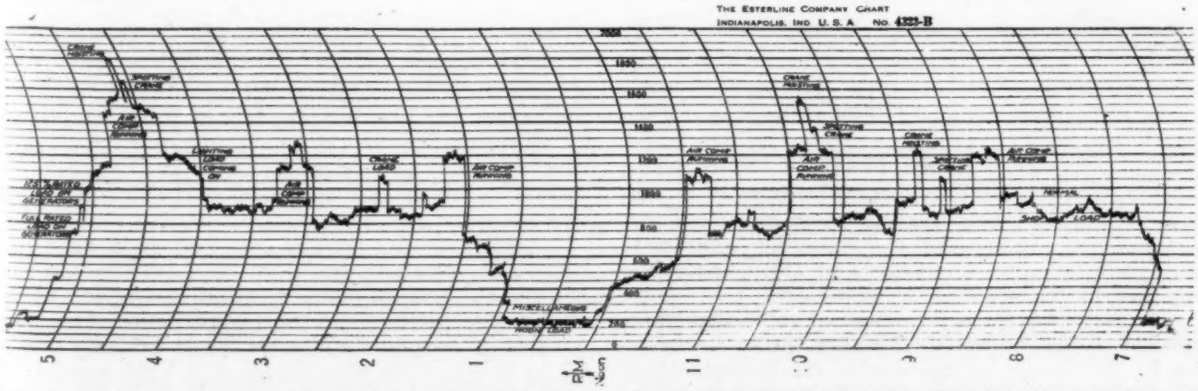
1916-1917.	Date.	1917-1918.	Date.	Increase. %
369,740	12/19/16	392,330	12/28/17	6.1

MAXIMUM DAY'S OUTPUT TO SYSTEM, KILOWATT-HOURS.

1916-1917.	Date.	1917-1918.	Date.	Increase. %
5,176,527	12/19/16	5,456,758	12/13/17	5.4

The increase in kilowatt-hours output for the year 1917 over 1916 was practically double the above percentages of increase in maxima, thus making a satisfactory all-around showing, since a larger increase in output than maximum means an improved load-factor.

Huge Lamp Contract.—The contract for furnishing 500,000 incandescent lamps to the Municipal Lighting Department of Seattle, Wash., has been awarded by the Board of Public Works to the Pacific Lamp & Supply Company, Prefontaine Building, Seattle. The contract amounts to about $100,000.



Daily Load Curve of Private Plant, Showing Typical Day's Load, Effect of Operating Various Machines Upon Peak Load, and Overloading of Generating Apparatus.

Contracting-Construction

Electrical Safety Code for Construction—Some Simple Soldering Kinks—Flour-Mill Wiring—Among Contractors

SAFE INSTALLATION OF ELECTRICAL UTILIZATION EQUIPMENT.

Electrical Contractors Must Become Familiar with the Rules of Part 3 of the National Electrical Safety Code.

An electrical contractor engaged in the installation, maintenance and operation of electrical circuits and equipment should have a very good idea of the safety requirements in installations he makes in factories, stores, theaters, hotels, dwellings, and similar places where electricity is utilized by the public in general. He must realize that all electrical installations made, aside from on premises or lines of central stations, electric railways or other electric utilities, are used by persons but little familiar with electricity. Therefore there is greater need for safeguarding of electrical equipment in factories, mills and the like than there is in a power house or substation, the employes of which are supposed to be trained electricians.

While an experienced contractor may have a general idea of the kind of electrical construction that is clearly safe and what is manifestly unsafe and therefore hazardous to the lives of occupants of the premises he wires, he is unlikely to have such an extensive and trustworthy knowledge of safety requirements as will enable him to decide exactly where the dividing line between safe and unsafe construction lies. In questions relating to safety from fire hazards he has an excellent guide in the rules of the well-known National Electrical Code, which was first drawn up in 1897, but in deciding questions dealing with electrical life hazards he has had until recently no set of rules of general applicability for minimizing the life and accident hazard associated with unguarded use of electricity.

Importance of National Electrical Safety Code to the Contractor.

The National Electrical Safety Code now provides these much needed safety rules for electrical installations. This code has been up before the electrical industry for several years and the present edition of it has been out since November, 1916. Central station, electric railway, telephone and other electric utility companies are fairly familiar with this code, since the major portion of it applies directly to them. Electrical contractors, however, are almost as a rule unfamiliar with the National Electrical Safety Code, although they will be called on more and more to conform their construction methods to an important part of the Code. Inquiry among numerous contractors has established this fact, many of them confessing they have never heard of the new Code.

The Safety Code is the result of more than three years of patient and painstaking study and investigation by the Bureau of Standards, Washington, D. C. It is doubtless the most carefully drawn up set of rules ever laid before the electrical industry and, being prepared by a government authority, it is especially important that all electrical men be well acquainted with at least those provisions that concern them most. Electrical contractors are particularly interested in Part 3 of the Code, which gives the Rules for the Installation and Maintenance of Electrical Utilization Equipment. By this is meant practically all equipment making use of electricity for purposes other than its generation, transmission and distribution. The contractor is evidently vitally concerned with this important part of the Code, especially since several municipal inspection departments are preparing to enforce it.

In order to bring to the attention of electrical contractors this portion of the National Electrical Safety Code, the Electrical Review will publish in the following issues the full text of Part 3 of the Code, together with a discussion of the rules of this part as prepared by the Bureau of Standards.

The following is a brief, unofficial review of how the Code came to be drawn up, how it was prepared, the scope of its rules, and its present and probable future status. This should give a fair general idea of the Code before Part 3 is taken up in detail.

Need for the Safety Code and How It Was Prepared.

Within the last four or five years the growth of the "Safety First" movement and the passage of workmen's compensation laws has directed a great deal of attention to accident prevention. Industrial commissions and safety councils have been organized to improve working conditions and minimize the hazards of employment. These and other interests working on the safety propaganda have attacked every danger to life and limb and instituted measures to educate employes and the public in general to be more careful. Inspection of plants has been necessary to point out unguarded machinery, exposed live electrical parts and countless other pitfalls to a careless or untrained workman. To make such inspections and safety requirements effective and uniform, certain rules must be given to the inspectors and other administrators having the improvement of safety under their charge.

The need for rules giving safety requirements in electrical installations was felt not only by inspectors of industrial commissions, casualty insurance companies, and the like, but also by municipal inspectors, by representatives of the public in general, by many telephone, railroad, central station and other utility companies, by manufacturers of electrical equipment, and others.

Under authority granted by Congress in 1913, the Bureau of Standards began an extended study of the hazards of electrical practice, including a review of all known regulations of electrical construction. Throughout this investigation and after the preliminary drafts of the Safety Code were prepared, a large number of conferences and meetings were held by the Bureau's representatives with representatives of all electrical

interests affected by the proposed rules. Numerous open hearings were held in various parts of the country at which the tentative rules were freely discussed and criticized. Based on these criticisms and on many tests of the adequacy of the rules, revisions were made to adapt the rules to the requirements found desirable in different sections of the country. Inconsistencies were eliminated and the arrangement of the Code made as logical and convenient as possible. Generous cooperation was given to the Bureau by practically all electrical interests both during the drafting and criticism of the rules, which may be said to have been more fully discussed and considered than any similar regulations submitted on electrical matters. As the final outcome of these conferences, hearings and their resulting revisions, the present form of the Safety Code was published in November, 1916.

Scope and Status of the National Electrical Safety Code.

The Code in its present completed form consists of two introductory sections and four principal parts. The first section gives definitions of 53 terms used throughout the Code. The other section gives general rules for protective grounding to be followed where grounding for this purpose is called for by any rule of the Code.

The principal parts include the following:

Part 1.—Rules for the installation of machinery, switchboards, and wiring in central stations and substations.

Part 2.—Rules for the construction of overhead and underground lines for the transmission and distribution of electrical energy and intelligence.

Part 3.—Rules for the installation of electrical apparatus and wiring in factories, residences, and wherever electricity is utilized for electric light, heat or power.

Part 4.—Rules for safeguarding employes when working on or near electrical machines or lines.

Each part of the Code is followed by a discussion consisting of a series of explanatory notes giving in some instances reasons for the rules, in others illustrations of their application, thus tending to eleminate the confusion and differences of interpretation so common with many rules of the old National Electrical Code of the National Board of Fire Underwriters.

The Safety Code is published as a volume of 323 pages, 7 by 10 inches. Copies can be obtained for 40 cents each by sending currency or money order to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking for Circular No. 54 of the Bureau of Standards on "National Electrical Safety Code."

The Bureau has modestly offered the present Code "for examination, trial and constructive criticism" and is eager to have it given fair and earnest application to the end that errors or desirable changes be ascertained as soon as possible. A few changes have already been indicated and in a new and revised edition to be published possibly before the close of this year these will be included. However, scarcely any changes have as yet been pointed out as desirable in Part 3, which is the portion of greatest interest to the electrical contractors, so it is not likely that important changes will be made in its rules in the near future. It is expected to revise the Safety Code from time to time as conditions and progress of the art require, just as it has been customary to make a biennial revision of the National Electrical Code.

Up to the present time no less than 16 state public utility and 5 industrial commissions have adopted the Safety Code in whole, or in part, or at least recommended its use. New York City has taken the lead among municipalties indorsing the Code. The International Association of Municipal Electricians and the Western Association of Electrical Inspectors have also indorsed the Code and recommended it for trial use. Some of the largest utility interests are making a trial use of it. The great preponderence of opinion so far after its merits have been tried out is heartily in favor of adoption of the Code. It is to be expected therefore that more and more cities, state boards, and other public bodies will require adherence to Safety Code provisions as greater familiarity therewith demonstrates their wisdom and desirability in eliminating or at least minimizing life and accident hazards still associated with the general use of electricity.

SOME SIMPLE KINKS IN SOLDERING WORK.

By A. Gemmell.

The accompanying sketches show a few simple kinks that I have found very helpful in the soldering line.

Fig. 1 shows a kink on how the common ladle can be arranged so as to be used as a pot carrier also. It

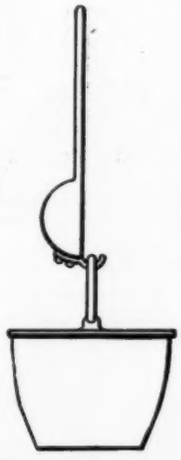


Fig. 1.—Combined Ladle and Pot Carrier.

is not necessary to have this hook very large. This method does away with carrying an extra handle or carrier for the pot.

Fig. 2 shows a simple solder mold which can be made out of plaster of paris. Wooden patterns of the size of the wire or bar solder that are used can be made and laid on a pane of glass. A wooden form the

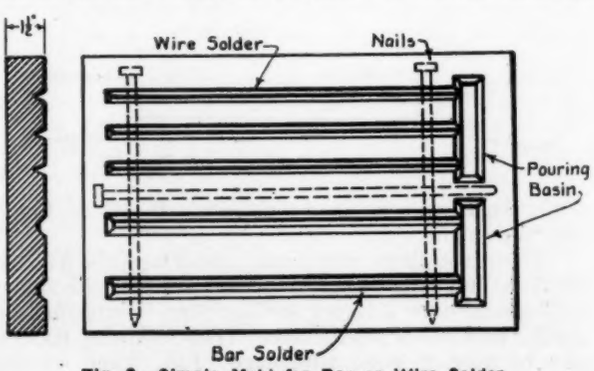


Fig. 2.—Simple Mold for Bar or Wire Solder.

size and depth of the mold required is then made and put on the glass. It is advisable to fasten the patterns onto the glass with just a very little shellac to hold them in position while pouring in the plaster. The mold is poured about half full of plaster of paris and then after this has partly stiffened, the stiffening nails or rods are laid in; the mold is then filled to the top. Let it set for a few hours and then remove the glass by pressing sidewise; if too much shellac is used the pattern will stick to the glass too strongly, and this is liable to damage the mold. After removing the glass, set the mold in an oven and drive out all moisture. The mold is now ready for use. This will be found to be very useful as many times you run short of bar or wire solder and it can be made in a short time.

Fig. 3 is a soldering-paste spreader that can be made from a narrow strip of metal with a slight spring to it, about three-eighths-inch wide and a little longer than the diameter of the box lid. When you are through with it, it can be kept inside the lid, as shown. This does away with hunting up a stick or using your knife, with which to put on the paste.

Fig. 4 shows an improved soldering iron handle.

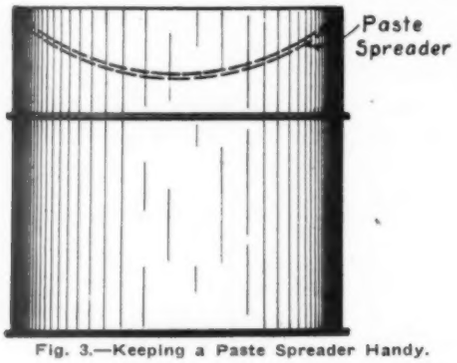


Fig. 3.—Keeping a Paste Spreader Handy.

It is very annoying to have the handle keep getting loose, which is caused mostly by the shank getting hot and charring the wooden handle. If the following method is tried, this will be prevented. Bore a hole in the handle about one-fourth or three-eighths inch larger, if possible, than the diameter of the shank. Wind sheet asbestos around the shank about half the depth of the hole, insert into the handle. Make a small calking tool and calk in snugly, then separate some of the asbestos into small pieces and calk in snugly up to the end of the handle. You will find that you will have no more loose handles by following this scheme.

Fig. 5 shows a handy soldering board whereon small articles can be soldered. This board has several good features. It gives you a level and smooth surface to work on and in places where there is no suitable place on which to lay the work, it comes in very handy. It also can be used to set the solder pot on

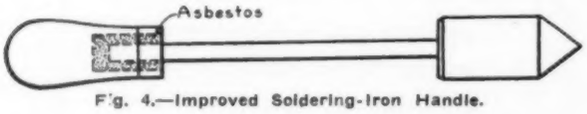


Fig. 4.—Improved Soldering-Iron Handle.

while working in finished buildings. It will be found useful in many ways.

There are times when neat soldering jobs have to be done and it is quite often the case that the solder will spread over a larger surface than is intended, no matter how much care is taken. The following method can be used to good advantage: Take some whiting

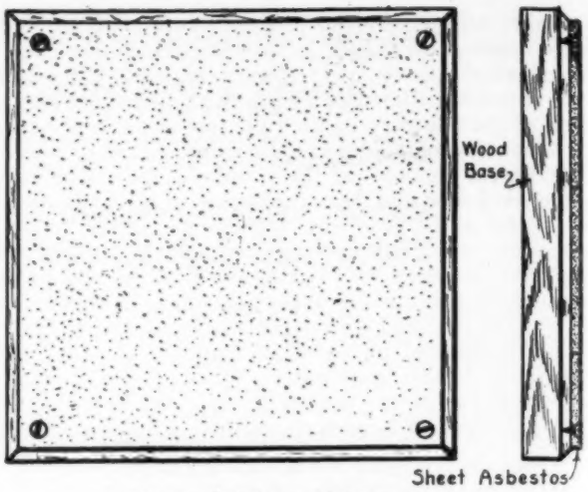


Fig. 5.—Board for Soldering Work.

and mix into a paste with water. Put it around the spot that is to be soldered, hold the hot iron near it a minute or two until dry, and then solder in the usual way. The whiting can then be removed easily.

A FEW SUGGESTIONS IN WIRING FLOUR MILLS.

By Walker T. Sheldon.

It is highly desirable that in wiring mills (where the atmosphere is normally laden with finely divided inflammable dust) such as woolen mills, planing mills, flour mills and grain elevators, the conductors should be inclosed in wrought-iron conduit. Open-work wiring is not desirable, in fact in many cases not permitted, because of the dirt that collects on the conductors and thereby introduces a fire hazard. Molding wiring is unsafe also, because in such locations the inflammable material associated with a wiring installation should obviously be a minimum.

All switches, cutouts, and starting rheostats or autostarters should be inclosed in dust-tight cabinets. All lamps should be suspended directly from the ceiling, because if lamps are installed on side walls the dust accumulates on their upper surfaces and sometimes, due to the heat of the lamp, ignites. Keyless sockets should be employed throughout, because the dust-laden atmosphere sometimes possesses the property of an explosive gas and may become ignited by the arc which is formed in a key socket when the key is turned. Frequently it is considered desirable to inclose all lamps which are installed under such conditions in vaporproof globes.

AMONG THE CONTRACTORS.

The Cynthiana Plumbing & Electrical Company was recently organized by J. F. Nooe, of Cynthiana, Ky., and will handle electric wiring, a full line of electric appliances and conduct a general plumbing, heating and gas-fitting business.

The Herman Andrae Electrical Company, Milwaukee, Wis., is busily engaged on the complete wiring of the new $1,000,000 club house of the Milwaukee Athletic Club. This is a 12-story fireproof building with gymnasium, separate swimming pools for men and women, bowling alleys, billiard room, dining rooms, and a large number of guest rooms. Exceptionally complete electrical equipment is being installed.

New Appliances

Holder—Duplex Switch—Regulator—Knife Switch—Control Unique Photography—Compressor—Insulators—Big Cranes

NEW HUBBELL SHADE-HOLDERS.

The growing use of porcelain and weatherproof sockets has induced the firm of Harvey Hubbell, Inc., Bridgeport, Conn., to extend its well-known line of shade-holders by the addition of types to fit such sockets. These are made in 2.25, 3.25 and 4-inch sizes for medium-base sockets and 3.25 and 4-inch sizes for mogul-base porcelain and weatherproof sockets. These new holders are made up of the solid

Hubbell 2.25-inch Shade-Holder for Medium-Base Porcelain and Weatherproof Sockets.

blanks used in manufacturing the present holders, the adaptation being secured by a special punching in the center and the attachment of the standard "P" holder as used on reflectors. An enlargement of the center punching and the use of three straps instead of two adapts these forms for use with mogul-base sockets.

TWO-CIRCUIT SWITCH FOR SINGLE-GANG BOX.

For controlling two independent lighting circuits from one point, the Bryant Electric Company, Bridgeport, Conn., has designed and added to its line of Perkins duplex flush switches a new switch that can be used as a substitute for two separate single-pole flush switches which require a two-gang switch box.

The new device consists of two of the well known Perkins type O push-button switches mounted in a

Bryant Two-Circuit or Duplex Flush Switch for Single-Gang Box.

porcelain cup, each switch having its own line and circuit terminals, so that separate feeds for the two circuits can be brought into the switch.

The switch fits into any shallow single switch box and takes the standard two-button plate, therefore the general appearance is enhanced by the use of the smaller plate, and the cost of material used is considerably reduced.

This switch is specially advantageous where the central-station company has a two-rate schedule. As the switch has separate feeds, a circuit at each rate can be passed through one box and controlled at the same point.

The new device, which is known as type O, duplex gang switch, No. 2709, is National Electrical Code standard, and is rated at 10 amperes, 125 volts; 5 amperes, 250 volts.

NEW ELECTRIC GRINDER REGULATOR MAINTAINS MAXIMUM PRODUCTION.

To maintain a steady maximum from electrically driven grinders in pulp mills, the General Electric Company, Schenectady, N. Y., has developed a regulator which maintains a practically constant load on the grinder motors. These regulators are in practical operation and giving very satisfactory results.

The regulator maintains a practically constant load

Automatic Regulator for Electrically Driven Pulp Grinders.

on grinder motors at any predetermined value, so that the current variations are held within such narrow limits that their influence on the electric system is practically negligible. This result is accomplished by automatically regulating the water pressure on the pockets by means of a motor-operated throttle valve.

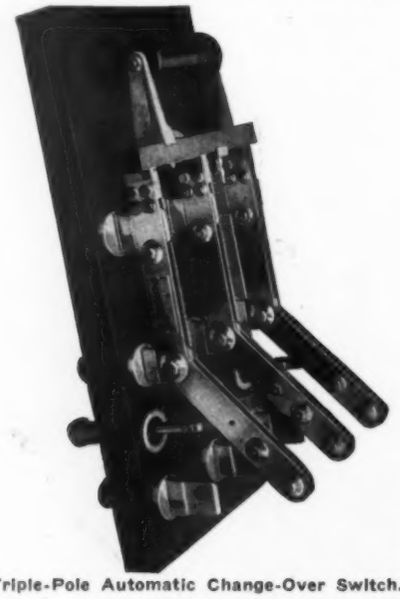
The regulator consists of a small induction motor which is connected through series current transformers to the feeder lines of the grinder motor. The motor of the regulator motor rotates through a small angle and actuates the throttle valve of the main water supply to the grinder, automatically reducing the water pressure when the load on the grinder motor starts to increase and conversely opening the throttle valve and increasing the water pressure to compensate for a falling load.

While this regulating device is simple and strong mechanically it is also very sensitive to the load changes and smooth in its operation. Actual service tests show that with a single three-pocket grinder, with instantaneous changes in load as great as 33⅓ per cent, the fluctuations on the driving-motor feeder circuit did not exceed 2 per cent.

While the results achieved by the regulator on the electrical system are excellent, the most important effect of its use is the very considerable increase in production secured. Without the regulator the grinder must of necessity operate for varying periods at reduced output when the pockets are being filled, whereas with the regulator in operation such reductions in load are instantly corrected by the changes in water pressure, so that the motor-driven grinder set, when provided with this regulator, is always operating at its maximum rate of production.

AUTOMATIC CHANGE-OVER KNIFE SWITCH.

The Electrical Engineers Equipment Company, of Chicago, Ill., has recently designed and manufactured for the New York Edison Company a triple-pole, double-throw, 300-ampere, 110-volt automatic knife switch. The switch proper is constructed according to the company's standard design, having double blades which are driven home over the clip contacts,



Triple-Pole Automatic Change-Over Switch.

spring washers being employed to secure proper contacting. The switch is also equipped with a low-voltage coil and a bell-alarm relay.

Normally the switch is closed into the upper contacts. These contacts are supplied from the customary source of power. In case this supply is interrupted the low-voltage coil operates, releasing three springs which throw the switch blades into the lower row of contacts. These latter contacts are supplied from a storage battery or some independent source of power. When the normal source of current is restored, a bell alarm is sounded which is a signal to the attendant that the switch should be thrown into the upper contacts. This operation is accomplished manually.

This type of switch is well adapted for use upon circuits where the continuity of the current supply is of utmost importance. In isolated power stations and substations, an interruption to the normal supply of power usually comes suddenly and without warning, leaving the station in darkness in addition to shutting down pumps and other auxiliaries at a time when they are most needed.

By the use of this switch, lights, motors, driving auxiliaries, etc., are instantly switched to the emergency source of power. This saves considerable confusion and leaves the station operatives free to direct their entire attention to restoring service upon the main busbars.

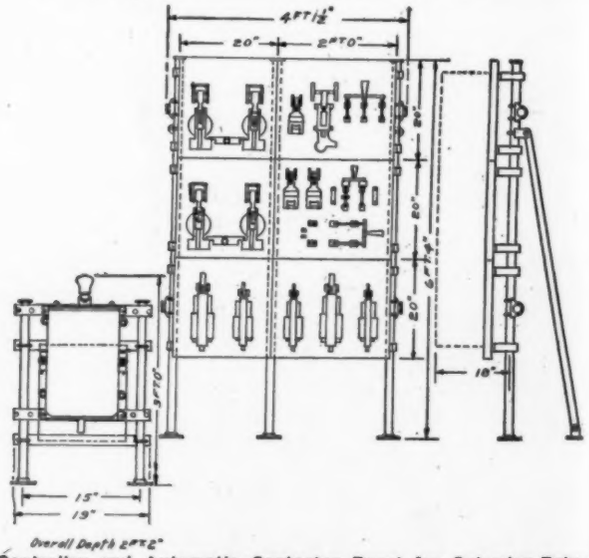
The Electrical Engineers Equipment Company is prepared to manufacture this type of switch for all conditions of service.

NEW ELECTRICAL CONTROL FOR CALENDERS.

A new system of semi-automatic control, for 115-230-volt, four-to-one speed, double-voltage, shunt-wound motors for driving rubber calenders, has been developed by the General Electric Company, Schenectady, N. Y.

The calender drive is operated through a master controller designed to give 115 or 230-volt operation with 18 field points on each voltage for speed regulation.

Throwing the master controller in one direction



Controller and Automatic Contactor Panel for Calender-Drive Motors.

starts the motor on 115 volts and the field is automatically kept at full strength during acceleration. The accelerating contactors are of the series current-limit type and have a load pick-up to insure that they will come in on light loads. When the final accelerating contactor closes, the motor will further accelerate to the full field-weakened speed at which the controller is set.

If a still higher speed is desirable, swinging the controller handle in the opposite direction will put the motor on the 230-volt line, where armature and field acceleration will occur as on the 115-volt line, 18 additional speed points being now available. There is no objection to starting directly on 230 volts if the operator so desires. Bringing the controller to the "off" position will allow the motor to stop.

A "safety first" feature of the equipment is the

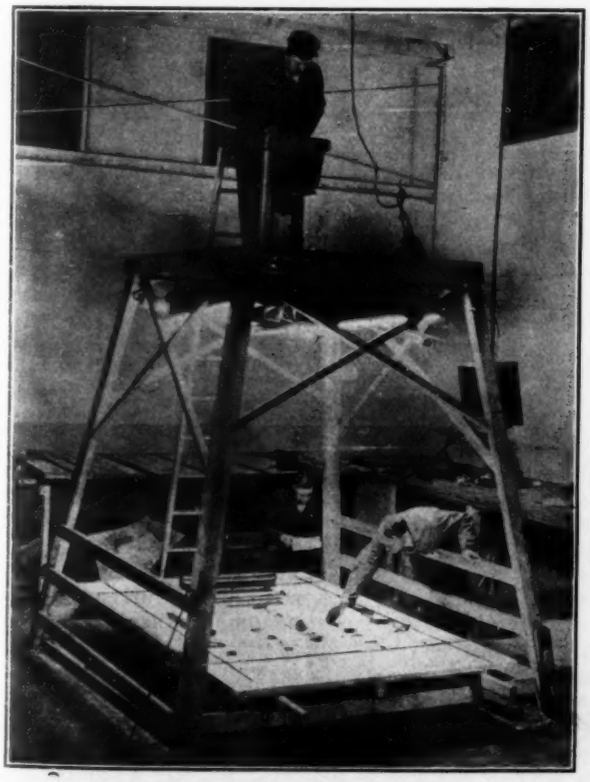
"quick stop" device. This is a small inclosed switch with a lever arranged to be operated by a rope, which runs across the calender where the workman can easily reach it. When this switch is pulled all line circuits are broken and the calender equipment is brought to a very quick stop by means of three-point dynamic braking. The calender drive cannot be started again until the stop switch is reset.

The entire system is extremely simple. There is not an electrical interlock on the control panel. This is an important feature, as in previous methods of control, which utilized electrical interlocking, the sulphur in the rubber mills formed a coating on the interlock contacts, which at times prevented them from making circuit. Mechanical interlocks are used in the new system and afford protection against the possibility of contactors sticking in. The accelerating contactors have a self-contained operating and calibrating coil, and the contactor is cut out after operating.

The motor used for the calender drive is the type RF motor, which is supplied in sizes up to 75 horsepower for single voltage, and 125 horsepower for double-voltage equipments. Where the single-voltage system is used, either automatic or semi-automatic control can be provided.

UNIQUE METHOD OF AUTOMOBILE-PART PHOTOGRAPHY USING MERCURY-VAPOR LAMPS.

A complete and accurate catalog of parts is one of the necessities for every automobile manufacturer. Every detail must be illustrated, either separately or assembled with others into one of the parts of the car. A unique method of taking the photographs necessary for these catalogs has been worked out by the Willys-Overland Company. In its photographic department at Toledo, Ohio, is an elevated platform under which can be placed a large flat wooden table. On this are arranged various items, each with its appropriate title and number, printed on a card, laid beside or below it. The boundary of the photograph is marked by black wooden strips. Through a hole in the platform the photographer focuses his camera upon the display below. Light is furnished by four Cooper Hewitt mercury-vapor tubes, hung underneath and near the edges of the platform. Due to the highly actinic quality of the mercury-vapor light, the exposure is much shorter than with other illuminants having the same apparent brilliancy.

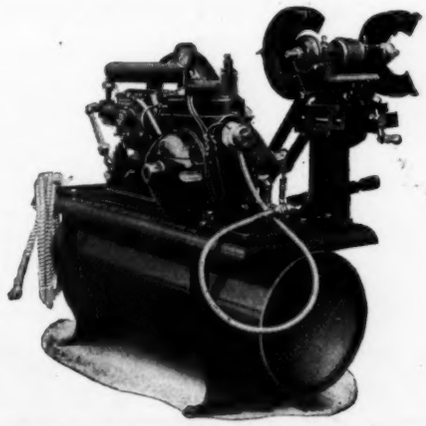


Taking Group Photograph of Machinery Parts From Above.

The great advantage of this device is that it enables the various parts to be associated with descriptive text, or explanations of the workings of complex apparatus. Much greater speed can be made in getting out instructions, since only one photograph need be taken of the entire group. Photographing from above is also very muck quicker than from in front, because the parts can be much more easily arranged on the horizontal platforms and removed or rearranged for the next picture than where it is necessary to tack up the parts on a vertical background.

ELECTRICALLY DRIVEN COMBINATION AIR COMPRESSOR AND BUFFING AND GRINDING HEAD.

The United States Air Compressor Company, Cleveland, Ohio, has recently announced a new combination air compressor and grinder outfit which is especially suitable for service in garages and similar places where compressed air is required.



Motor-Driven Compressor With Grinding and Buffing Head.

The outfit consists of a self-oiling air compressor with filtering trap, check valve and safety valve, buffing head, 30-gallon tank, air-pressure gauge, needle-point valve, pipe and fittings, armored hose, automatic air check, 6 feet of armored cable with plug, all mounted on a metal base to form a compact unit which requires but 48 by 20 inches floor space. The height over-all is 40 inches.

The air compressor is of the air-cooled, two-stage type. The low-pressure cylinder is 3 by 3 inches in size and the high-pressure cylinder is 1½ by 3 inches. The working pressure is 300 pounds per square inch and the capacity of the compressor is 4 cubic feet per minute. The compressor operates at 250 to 300 revolutions per minute. It is provided with an intake silencer which muffles the intake noise and tends to force air into the intake valve.

The cylinders and crank case are cast in one piece. A special type of check valve is used which is balanced between two bodies of air and is not subject to continuous seating and unseating as in the usual type of compressor. This permits the use of a special composition seat which makes a perfectly tight valve.

The outfit is equipped with an extra tank, the function of which is to permit the motor to start against no pressure and attain full momentum before assuming its full load, thereby eliminating the cause of burned-out motors and other motor trouble.

When the air in the main tank is raised to the proper pressure the automatic switch stops the motor and operates the automatic pressure release, which opens the starting tank to the atmosphere.

When the automatic switch again starts the motor it also closes the pressure release and the compressor begins pumping against no pressure. It always starts without strain.

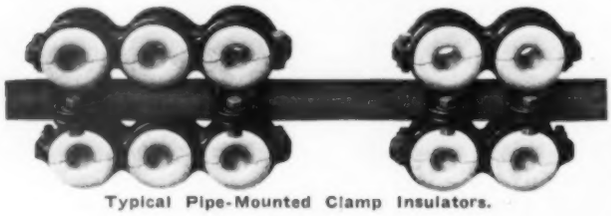
When the air in the starting tank attains a pressure slightly in excess of that in the main tank (requiring about 10 seconds), it opens the check valve and charges this tank until the proper pressure is reached, when the operations are repeated.

The buffing and grinding head is suitable for wheels of 8-inch diameter.

The outfit is equipped with a one-horsepower Robbins & Myers motor which permits the compressor and buffing head to operate at the same time. Outfits without this buffing head are equipped with a one-half horsepower motor of the same make.

NEW LINE OF HEAVY CLAMP INSULATORS.

An entirely new line of clamp insulators of rugged design has been placed on the market by the General Devices & Fittings Company, Chicago, Ill. These insulators are provided with a variety of mounting adaptations and are especially designed for installation of heavy conductors under severe conditions of service, such as in steel mills, shipyards, foundries, etc. The insulators are made up of dry-process porcelain and protected hardware. The insulation is impervious to heat, moisture or chemical action. This permits of



Typical Pipe-Mounted Clamp Insulators.

use with safety in moist places, electrochemical rooms for buses in ovens, etc.

Particular attention may be directed to the pipe-mounting units which may be had in 1, 2, 3, or 5-conductor types, and by removing the back clamp and doubling also 4, 6 and 8-conductor types. These make convenient fittings for pipe racks, tunnels, rear of switchboards, etc.

A partial list of construction jobs on which these insulating supports have been successfully used is the following: Switchboard buses; cableways, tunnels and galleries; feeders on ceilings, walls and roof trusses; switchrack makeup; transformer buses and cable risers; machine-pit runs, machine feeders; motor controllers and grid-stack leads; heavy contactor make-up, etc.

NEW CAPACITIES ATTAINED BY ELECTRIC CRANES.

As a result of speeding up of shipyards and industrial plants in 1917, there was a greatly increased demand for cranes, electrically operated and controlled. Six of the largest of these cranes were equipped with motors made by the General Electric Company and in most cases with G-E control.

Two of these cranes were of 225-ton capacity, the

Two Big Coal-Handling Gantry Cranes With Simplified Dynamic Braking for Motor-Driven Hoist.

total motor rating of each aggregating 420 horsepower. A third crane of the same capacity had motors with a total intermittent rating of 850 horsepower. The two main hoist motors in this case each had a rating of 250 horsepower for continuous, and 425 horsepower for intermittent service, giving a hoisting speed for 225 tons of 40 feet per minute, and 120 feet per minute for 60 tons. Due to the high and variable speeds required, the large current demands could not be handled to the best advantage through the usual arrangements of rheostats and contactors, and Ward-Leonard control was therefore provided, this being the first application of this system of control on large cranes.

The remaining three cranes were the largest capacity units of this type ever built, being designed for a full-load lift with the main hoist hook of 330 tons at 12.6 feet per minute. The power equipment for each crane comprised two 200-horsepower main hoist motors, two 105-horsepower auxiliary hoist motors, an 80-horsepower and a 30-horsepower motor for main and auxiliary trolley, and two 50-horsepower motors for bridge motion; all these capacities were intermittent ratings.

Two high-speed, alternating-current, hammer-head, coal-handling, gantry cranes, provided with a unique system of dynamic braking, were installed at the La Belle Iron Works plant at Steubenville, Ohio. Each crane is equipped with a 375-horsepower slip-ring induction motor direct-coupled to a 40-horsepower direct-current motor, and hoists a 4-ton bucket of coal at 500 feet per minute. The dynamic braking is obtained by combining the small direct-current motor with the alternating-current motor so that the direct-current unit serves as an exciter and gives dynamic braking which is comparable with that ordinarily obtained with direct-current motors on this class of work. This is the first application on any large scale of this system of dynamic braking for cranes, which is more economical in first cost and has a number of practical operating advantages.

Trade Activities

Ilg Electric Ventilating Enlarges Quarters—Lux Manufacturing Awarded Municipal Contracts—Catalogs Distributed

George Cutter Company, South Bend, Ind., has issued a new bulletin (No. 3338) on its flood-lighting projectors. It lists the company's new "Standard" projector as well as the "Universal" projector that was placed on the market last year. Each of these units is described in detail and illustrated. Engineering data and illustrations are given on the use of flood-lighting projectors. A list of applications is given and typical uses shown.

Inland Electric Company, 14-16 North Franklin street, Chicago, is sending out a booklet illustrating and describing the Steelite line of extension fixtures, of especial value in industrial plants. They offer protection to the lamps, reduce fire hazards and save the cost of constant repairs. According to the company, the saving afforded in cords alone a year in the average plant will net a profit which will offset the difference in cost between the ordinary extension and Steelite. These fixtures are fully approved by the National Board of Fire Underwriters and bear the label of the Underwriters Laboratories.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just issued publication No. 220, a four-page pamphlet, illustrating and describing C-H electric beer vat dryers, and tells of some of the advantages of drying beer vats by electricity. The C-H beer vat dryers are made with two and three heats, and in three sizes, ranging from 750 to 1250 watts on low heats and 3000 to 5000 watts on high heats. The pamphlet also illustrates a direct-current motor starter, a porcelain push socket and a porcelain push switch especially adapted for use in breweries and other damp places.

The Breco Electric Company, Toledo, Ohio, was organized some time ago to manufacture the Breco rectifier, rotary converter, desulphator and other apparatus. The Breco converter, formerly known as the Murphy, consists of a graphite-arc valve, used in connection with a commutator, permitting flow of current in the desired direction, and has a special electric timer that prevents sparking and secures proper commutation. When this rectifier is adjusted for normal operation, it is assured, no reverse current passes through it. Its operation eliminates the use of electrolytes, fragile bulbs and delicate vacuum tubes. It is of special utility in service stations for charging storage batteries in electric cars and trucks, and for power purposes. The Model A Breco Charger has a capacity of 3 to 18 cells; 6-volt or 12-volt batteries may be charged in series, in any combination, up to 18 cells, at an average rate of about 10 amperes. It is automatic in action. If the line fails, it stops charging and cuts out the battery; when power is resumed, the charging again starts. The company's literature contains full descriptions and illustrations of its line of apparatus, including its desulphator.

Despatch Manufacturing Company, Minneapolis, Minn., in Catalog II, recently issued, groups a partial list of its extensive line of electric ovens and electric heating appliances, which are designed for all purposes. Despatch electric ovens are furnished in any size, shape and style. They are simple, economical and practical in design, and so constructed as to insure long service and satisfaction. Open heating units are used in these ovens and appliances and are guaranteed not to burn out or crack. The wire used in these units is a metal alloy drawn according to the company's own formula and is specially adapted to withstand intense heat. Various styles of ovens, including test-baking, baking, drying and demonstrating, as well as air heaters, proofing cabinets and other appliances are illustrated and described in detail. The catalog contains complete data in regard to the maximum current, consumption of watts, baking space, etc., and particular information concerning this line of heating devices will be furnished upon request. Inclosed with the catalog is other circular matter dealing with portable heaters and other appliances, and a revised price list applying to Catalog II, which supersedes all previous lists.

Detroit Fuse & Manufacturing Company, manufacturer of electrical safety devices, Detroit, Mich., has changed its corporate name to **Square D Company.** This change has been deemed advisable inasmuch as the company has disposed of its fuse business and will engage in the manufacture of Square D safety switches, exclusively.

Lux Manufacturing Company, Hoboken, N. J., has been awarded the 1918 municipal contracts for Lux lamps of New York City and Chicago; this is the first year in which the same brand of lamps has been chosen by both cities. New York City has shown its preference for Lux lamps through the award of three contracts during the past four years. The company feels a certain justified pride in the fact that its product has been selected from the extensive field represented, to supply the incandescent lamp requirements of the two greatest American cities.

W. R. Ostrander & Company, manufacturers of and dealers in electrical supplies, with offices at 371 Broadway, New York City, have entered into negotiations with the Hygrade Lamp Company of Salem, Mass., to represent that concern in New York territory and will handle all orders for this well-known lamp. A complete stock of Hygrade lamps will be carried in stock by the Ostrander company at both 371 Broadway and its Brooklyn warehouse located at 1433-39 Dekalb avenue, and will continue the liberal discount extended by the Hygrade Lamp Company.

Ilg Electric Ventilating Company, Chicago, Ill., has purchased a large tract of land on Elston avenue and Snow street, aggregating 214,282 square feet, upon which it will erect a group of high-class, modern factory buildings. The business of the company (manufacture of motor-driven ventilating equipment) has had a very rapid growth. Starting in small quarters in Kinzie street, the company found it necessary to erect in 1910 the first of its buildings on Whiting street; in 1915 and 1917 additional buildings were put up extending into Wells street. To permit of future growth, it was evidently necessary to secure a site of larger area with good shipping facilities, which has now been done. The new buildings will be erected in unit sections of 300 by 60 feet; each unit will be a four-story fireproof building with the most efficient and complete facilities. The new site is said to have cost $128,570 and the buildings will cost about $600,000.

Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., has just issued a circular dealing with "Electrical Equipment in the Woodworking Industry." The publication is profusely illustrated by views of motor driven woodworking machinery both alone and as installed in representative woodworking plants. Starting with the general subject of motor drive, the reasons for its adoption, such as increased production, better light, greater safety to employees, higher efficiency of machines, more accurate knowledge of cost and greater freedom in power distribution are explained. The next section is devoted to features of Westinghouse motors which make them suitable for this work, such as rigid construction, sparkless commutation of direct current machines, and simplicity and reliability of oiling. Assistance which may be rendered to owners of woodworking plants is described; this includes advice as to layout of plant and proper motors to use, and prompt repair service in case of breakdown. The woodworking plant of Ferguson Brothers Company, Hoboken, N. J., is described and illustrated in a third section. This concern manufactures furniture and wooden novelties of various kinds, and is completely motor equipped. The remainder of the book gives horsepower requirements and other data for many different styles of woodworking machinery, which will be of much value to those having to do with this class of industrial activity. Copies of this circular may be obtained by addressing a request to any Westinghouse district office.

Men in Service

A. I. E. E. Well Represented—R. J. Gaskill Commissioned Lieutenant—W. E. Harkness Becomes Major—Promotions

CHESTER SMITH, Kansas City, Mo., attorney for the Kansas City Railways Company, has been commissioned a captain in the ordnance department and will hereafter be stationed in Washington, D. C.

WALTER A. CARPENTER, formerly assistant city electrician at Modesto, Cal., has been promoted to the rank of sergeant with the 332nd field battalion Signal Corps, Company C, now stationed at American Lake.

J. Y. HAMBLEY, formerly of the distribution department of the Duquesne Light Company, Pittsburgh, Pa., recently finished his flying training somewhere in South Carolina and is now "flying for the U. S. A." in France.

WESTINGHOUSE AIR BRAKE COMPANY, with general offices and works at Wilmerding, Pa., and branch offices in the principal cities of the country, now displays a service flag showing the figures 154 in the center of a white field indicating that that number of employes have joined the service.

SAMUEL W. HARPER, secretary-treasurer of the Consolidated Telephone Company of West Virginia, Wheeling, W. Va., has been appointed a national director of the American Red Cross with headquarters at Washington, D. C., and will serve the organization on the "dollar a year" basis.

L. C. GRIFFITS, president of the Seymour Mutual Telephone Company, Seymour, Ind., was recently appointed county chairman for the sale of war savings and thrift stamps in Jackson county. He will undertake the organization of the county to promote the sale of stamps and expects to complete the campaign by the end of the year.

SOUTHWESTERN BELL TELEPHONE SYSTEM, St. Louis, Mo., now displays a service flag containing 616 stars, representing that number of its men in various branches of Government service. Since the publication of its last issue of the News, 135 names have been added to its roll of honor and four names have been checked off due to discharge from service.

PACKARD ELECTRIC COMPANY, Warren, Ohio, devotes the front cover of its February issue of Packard Doings to its roll of honor which contains the following names: J. Ed. Erickson, G. R. Furst, Clyde Green, Fred Schultz, Duncan Macauley, Nick Ferro, Lee Roberts, George Tuttle, James Kane, Ernest Armstrong, L. H. Alline, F. E. Homrighouse, Leland Ensign, John Thornberg, Paul Bartholomew, Tony Dell, George Smith and John Tyler. This number of the house organ is the Camp Edition and is given over to letters and poems of its men in service, and contains a number of their pictures and views of the various camps at which they are located.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

DOUGLAS A. FELL of the Northwestern Electric Equipment Company, St. Paul, Minn., has been appointed a sergeant in the 310th Field Signal Battalion, now stationed at Camp Custer, Mich.

T. W. MANN, formerly of Paul's Electric Store, Medford, Ore., who enlisted in the aviation corps last summer, has been promoted to the position of master signal electrician in the 372d Aero Squadron and expects shortly to see actual service in France.

C. H. COLQUITT, formerly of the South Side district of the Duquesne Light Company, Pittsburgh, Pa., and now in service on the U. S. S. Elfrida, has sent greetings to the company in the form of a poem, which appears in the February issue of the Light Company News.

FRANK A. STEIN, formerly of the distribution department of the Duquesne Light Company, Pittsburgh, Pa., and of the Beaver County Light Company, New Brighton, Pa., is now a second lieutenant in the Engineers Reserve Corps, and stationed with the 56th Engineers at Washington Barracks, Washington, D. C.

ROBERT J. GASKILL, formerly superintendent of fire alarm and police telegraph, Ft. Wayne, Ind., recently recently received a commission as second lieutenant, Field Artillery of the National Army. He was born in Pennsylvania, May 10, 1885, and entered the service of the Western Union Telegraph Company in 1903 at Delphos, Ohio. He later became associated with the American Telephone Company and in 1906 was appointed assistant to the superintendent of fire alarm and police telegraph at Ft. Wayne and upon the death of his predecessor became superintendent. In 1916 Mr. Gaskill was elected president of the International Association of Municipal Electricians at the Baltimore convention.

DE LA VERGNE MACHINE COMPANY, New York, N. Y., lists the names of 44 employes on its roll of honor who have enlisted in the army and navy.

W. L. WESTON, formerly with the Paducah Light & Power Company, Paducah, Ky., is now serving as a lieutenant in the United States army in France.

C. M. BROWN of the general engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been assigned to a U. S. battleship as a junior lieutenant.

PAUL H. MANCHESTER, formerly connected with the Pacific Gas & Electric Company, Martinez, Cal., has joined the 37th regiment of engineers, which is almost exclusively composed of central station men.

LIEUT. A. W. DAVISON has been transferred from Washington to Niagara Falls, N. Y., where he is supervising chemical plant construction and experimental operation at the Oldbury Electrochemical Company.

WILLIAM BRADFORD, formerly chief clerk in the Wilmington business office of the Delaware & Atlantic Telephone & Telegraph Company, has been promoted to the rank of second lieutenant in the National Army, and is now in the Adjutant General's Department.

W. E. HARKNESS, well known in electrical circles, having for several years been identified in the development of the Gill selector, was recently appointed a major in the United States Army and is connected with the Ordnance Department at Washington, D. C.

COMMONWEALTH EDISON COMPANY, Chicago, through its War Relief Committee, reports that letters have been sent to 333 of its soldiers in cantonments in the United States, each letter containing three books of Smileage Coupons, which were sent with the compliments of the company.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, 33 West 39th Street, New York, N. Y., in the February edition of its Proceeding publishes an additional list of its members who have joined the colors. The Institute now lists on its roll of honor the names of 686 members in army and navy service with the United States and her Allies.

BELL TELEPHONE COMPANY OF PENNSYLVANIA and associated companies, with executive offices at Philadelphia, Pa., lists the names of 677 employees who have joined the colors. The enlistments in the various branches of Government service are as follows: United States Army, 103; U. S. National Guard, 137; U. S. Reserve, 67; U. S. National Army, 290; Training Corps, 10; U. S. Navy, 61; U. S. Marine Corps, 5, and Canadian Army, 4.

Personal

Charles H. Keeling Joins Square D Company—Changes in Personnel National Lamp Works—L. S. Ready Promoted

N. H. BOYNTON, who for the past six years has been manager of the publicity department of the National Lamp Works of the General Electric Company, has been appointed general manager of the Buckeye Electric Division, succeeding L. P. Sawyer. Mr. Boynton carries to his new position a wide

N. H. Boynton.

experience in lamp merchandising and sales promotion and a range of acquaintance that covers the entire industry. He is succeeded by P. B. Zimmerman in the managership of the publicity department.

J. P. BALOUN, formerly chief of the drafting department of the Pacific Gas & Electric Company, San Francisco, Cal., has accepted a position with the Pacific Coast Shipbuilding Company.

R. T. SULLIVAN, general manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, was recently elected a director of the Republic Railway & Light Company which controls the Youngstown Utility property.

ASA WILLIAMS, superintendent of the Owensboro Water & Light Plant, the municipal plant of Owensboro, Ky., has resigned to take a similar position with a large canning company, and will be succeeded by W. M. Watson, who has been connected with the lighting plant.

CHARLES H. KEELING, formerly connected with the Renfrew Electric Manufacturing Company, Ltd., Renfrew, Can., has joined the selling forces of the Square D Company, Detroit, Mich., which he will represent in Canadian territory with headquarters at Toronto. He was engaged in the contracting business for six years during which time he completed some of the largest electrical installations in Ottawa. Mr. Keeling was the first sales representative of the Renfrew Electric Manufacturing Company, and in 1916 was appointed sales and advertising manager of that company.

GEORGE W. WRIGHT, Paterson, N. J., has been appointed one of the new members of the Board of Public Utility Commissioners by Governor Edge.

EDWARD L. DONOVAN, for several years sales manager of the Northern Indiana Gas & Electric Company, Logansport, Ind., has been appointed manager, succeeding George M. Dolley, who recently resigned.

J. J. FAGAN, formerly of the new business department of the Montgomery Light & Power Company, has been transferred to a similar position with the Salina Light, Power & Gas Company, both of which companies are subsidiaries of Henry L. Doherty & Company, New York City.

F. T. MUMMA, electrical engineer in charge of the electric substations of the Chicago, Milwaukee & St. Paul main line, was recently appointed superintendent of the telegraph and telephone department on the Anchorage division of the Alaska Railways and succeeds Herbert Gaytes who resigned.

L. P. SAWYER, until recently general manager of the Buckeye Electric Division of the National Lamp Works, of the General Electric Company, Cleveland, Ohio, has left that position in order to devote his entire time to activities connected with the general offices

L. P. Sawyer.

of the Lamp Works at Nela Park. These activities are an extension and the outgrowth of the important committee work, which has long occupied a great deal of Mr. Sawyer's attention. He was manager of the Buckeye lamp business for 14 years, during which period it increased in volume many times over.

LESTER S. READY, who has been assistant engineer in the gas and electric department of the Railroad Commission of California for several years, was recently promoted to the position of electrical engineer of that department and succeeds F. Emerson Hoard, who is now in Government service.

CHARLES B. HILL, Buffalo, N. Y., has been appointed chairman of the Public Service Commission for the second district by Governor Whitman.

P. B. ZIMMERMAN, who for some time has been connected with the National Lamp Works of the General Electric Company, Nela Park, Ohio, has been

P. B. Zimmerman.

appointed manager of the publicity department. He succeeds N. H. Boynton, who has become general manager of the Buckeye Electric Division of the company at Cleveland, Ohio.

H. R. STEVENS, of the firm of Stevens & Rockwell, consulting electrical engineers, Seattle, has joined the forces of Stone & Webster as electrical engineer for the northwest district.

H. I. COSGROVE has been named master mechanic of the Rock Island Southern Railway Company, with headquarters at Rock Island, Ill. He has served for 25 years with various railroads in a similiar capacity in the western and southern parts of the United States.

W. E. IVES, formerly in the erection department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has become a member of the Doherty organization with headquarters at New York City, and is at present assisting in turbine maintenance work in the Ohio properties.

RALPH A. BEEBE, a civil engineer of San Francisco, Cal., has been appointed by Mayor Davie of Oakland to fill the newly created position of efficiency engineer under the department of public affairs. He will assume his new duties at the first of the month and will for the present gather information desired by the mayor relative to traction and power companies with a view to placing them under municipal ownership. Mr. Beebe is a graduate of the 1907 engineering class of Stanford University and since 1910 has been engaged as a construction engineer for the Federal Telegraph Company.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

SPRINGFIELD, MASS. — Gilbert & Barker Manufacturing Company has commenced the construction of an addition to its power plant in connection with extensive improvements at its works. The new structure is to provide for increased capacity.

WEST SPRINGFIELD, MASS.—Boston & Albany Railroad Company, Boston, has awarded a contract to the C. A. Dodge Company, Amherst street, Cambridge, Mass., for the erection of a one-story local gas producer building, about 15x55 feet in size.

STAMFORD, CONN.—Fairbanks Storage Battery Company, Inc., 438 Atlantic street, has awarded a contract for the construction of a one-story storage battery station, about 40x120 feet in size, on Fairfield avenue, Bridgeport. The structure is estimated to cost $20,000. W. A. Smith & Son, 188 Cannon street, Bridgeport, are the contractors.

PROVIDENCE, R. I.—Providence Gas Company, Turks Head building, is rushing to completion the erection of a two-story laboratory building, and one-story addition to its meter house at Sassafras Point. The two structures are being erected at a cost of approximately $80,000. The Charles D. Maguire Company, Providence, is the contractor.

BINGHAMTON, N. Y.—Binghamton Light, Heat & Power Company has been awarded a contract for supplying electric service for the operation of an addition to the plant of the Ballard Silk Company now in course of construction. About 50 horsepower will be required.

BROOKLYN, N. Y.—United States Government, Navy Department, has awarded a contract to the Child & Scott Company, 112 Webster street, New York, for improvements and alterations in its local power plant at the navy yards. C. W. Parks, chief of the Bureau of Yards & Docks.

BUFFALO, N. Y.—Recommendations have been made to the City Council by Commissioner Kreinheder for changes in the gas-lighting system of the city, to include the electrification of the entire street-lighting system.

LONG ISLAND CITY, N. Y.—New York & Queens Electric Light & Power Company, 444 Jackson avenue, has acquired property comprising about nine and one-half acres at the intersection of the Long Island Railroad and Trotting Course Lane, Elmhurst, to be used, it is said, for extensions.

LONG ISLAND CITY, N. Y.—New York & Queens County Railway Company, 9 Borden avenue, has abandoned its former power plant fronting the East river, and leased the property to the Maritime Warehouse Corporation.

SYRACUSE, N. Y.—County Fuel Administrator Carleton A. Chase has made announcement that effective March 1, the order providing for six "lightless nights" weekly will be rescinded, two "lightless nights" only, Thursday and Sunday, to be observed.

SYRACUSE, N. Y.—The plant of the Syracuse Lighting Company was temporarily disabled on February 22, due to the burning out of 20 cables caused by the failing of a 30,000-volt feed line on one of the 23,000-volt transmission wires of the company.

TONAWANDA, N. Y.—Announcement has been made by Frank M. Gordon, manager of the Tonawanda Power Company, that orders have been received from the Government prohibiting all companies distributing hydroelectric power generated by Niagara Falls from contracting with new customers for power service or increasing their present capacity.

AMPERE, N. J.—The Crocker-Wheeler Company, manufacturer of motors, etc., has taken out a building permit for the construction of an extension to its power house.

BORDENTOWN, N. J.—Borough Council considering immediate installation of electric fire-alarm system.

DOVER, N. J.—New Jersey Power & Light Company has been awarded a renewal of its contract with the borough officials of Wharton for a period of five years.

GLOUCESTER, N. J.—Plans are being prepared by the City Council for extensive improvements in the electric street-lighting system.

NEWARK, N. J.—Diehl Manufacturing Company, manufacturer of motors, fans, etc., has had plans prepared for the construction of a four-story manufacturing plant with four-story wing, about 60x300 feet, to be located at Frelinghuysen and Evergreen avenues. William Lehman, 738 Broad street, Newark, is the architect.

NEWARK, N. J.—Submarine Boat Company, Port Newark Terminal, has commenced the construction of a series of power houses between its various shipways. The plants comprise three structures between ways No. 1 and 2, No. 3 and 4, and No. 5 and 6. Rapid progress is being made in the erection of two new steel fabricating shops, main power plant, machine shops, riveting works and auxiliary structures. The company is also constructing erecting towers and derricks.

TRENTON, N. J.—The City Commission has granted approval of an appropriation of $86,000 to provide for the operation of its electric street-lighting system, as requisitioned for in the annual budget for 1918. Due to the improved fuel situation, notice has been issued that two "lightless nights" only will be in effect each week.

BRADFORD, PA.—Fire, on February 27, destroyed a portion of the power plant of the Bovlard & Seyfang Manufacturing Company, with a total loss estimated at $10,000.

CHESTER, PA.—Beacon Light Company is making rapid progress in the erection of its new power house, boiler plant, turbine hall, switch house, machine shop and coal tower at its plant, the entire work being estimated to cost approximately $2,500,000. This company is a subsidiary of the Philadelphia Electric Company, Philadelphia. The Chester Construction & Contracting Company, Otis building, Philadelphia, is the contractor.

COUDERSPORT, PA.—The Home Electric Company has filed notice with the Public Service Commission of a bond issue for $22,000 to provide for improvements, etc.

HARRISBURG, PA.—Notices have been filed with the Public Service Commission by Pennsylvania Power Company, New Castle Electric Company and Shenango Valley Electric Company of increases in unit rates for wholesale power consumers.

HARRISBURG, PA.—Penn Public Service, Penn Electric Service, and Citizens' Light, Heat & Power Companies of Pennsylvania, operating in Blair, Cambria and other central counties, have filed notices with the Public Service Commission of withdrawals of schedules for such service as "restricted use of power" and further changes in rates.

INDIAN CREEK, PA.—Mountain Water Supply Company, Commercial Trust building, Philadelphia, has had plans prepared for the construction of a one-story reinforced concrete local power plant, about 30x70 feet in size. King & Wightman, 1513 Walnut street, Philadelphia, are architects.

LEMOYNE, PA.—United Electric Company is making rapid progress in its extensive improvements at the local plant, approximately 50 per cent of the work being completed.

NEWPORT, PA.—Juniata Public Service Company is making rapid progress in the construction of a new power line from Montgomery's Ferry to Liverpool. The company, which supplies power to Juniata, Perry and upper Dauphin Counties, is also making other improvements in its system.

ORRISTOWN, PA.—The citizens of Orristown have formed an organization to take steps to light that borough by electricity.

PHILADELPHIA, PA.—Boger & Crawford, East Ontario street, near Janney street, have recently completed improvements in their power plant, including the installation of a 150-horsepower tubular boiler, to provide for increased capacity.

PHILADELPHIA, PA.—In connection with the complete electrification of its Philadelphia-Chestnut Hill branch, the Pennsylvania Railroad Company is planning to commence testing operations on March 3, to continue until April 1, when the line will be formally opened.

PITTSBURGH, PA.—Central District Telephone Company has issued notice to its stockholders of a meeting to be held on April 26, for the purpose of acting on the sale of the company to the Bell Telephone Company of Pennsylvania.

READING, PA.—Metropolitan Edison Company has commenced the erection of the structural steel in connection with its boiler plant at the West Reading power station. Immediately upon completion of the structure the company will install two new boilers of 1000 horsepower each. It is expected that the building will be completed within the next month.

WILLIAMSPORT, PA.—Lycoming Rubber Company, Rose street and Erie Avenue, has had plans prepared for the construction of a one-story power house to be located near Rose street. The Lockwood Greene Company, 93 Federal street, Boston, Mass., is engineer.

LEWES, DEL.—To aid in the conservation of fuel, the Board of Public Works has issued orders for all street lights to be extinguished at 10 o'clock each evening.

WILMINGTON, DEL.—The Public Service Commission has granted permission to the Wilmington & Philadelphia Traction Company to increase its rates for electric current. The rate for domestic lighting will be increased from 8½ to 9 cents per kilowatt hour.

BALTIMORE, MD.—Bartlett-Hayward Company, Scott and McHenry streets, has awarded a contract to Morrow Brothers, Fidelity building, Baltimore, for the construction of a transformer station, about 28x50 feet, at Columbia avenue and Putnam street.

FIRECO, W. VA.—Battleship Coal Company, Princeton, is planning for the construction of a central power plant at its mines. H. E. Hines is president.

BADEN, N. C.—Tallassee Power Company will erect 300 additional buildings at its plant this spring.

DUNN, N. C.—General Utility Company, recently incorporated with a capital of $100,000, is planning for the immediate installation of an electric plant to cost about $25,000, to have a capacity of approximately 300 horsepower.

ROCKY MOUNT, N. C.—The city is having plans prepared for improvements and alterations in its electric lighting plant, including the installation of a 300 horsepower Heine type boiler. A. S. Lyon, superintendent.

WARRENTON, N. C.—Warrenton Elec-

tric Light Company is considering the construction of a three-phase 2200-volt transmission system.

CHARLESTON, S. C.—Consolidated Electric Company is considering an increase in the capacity of its power house on Meeting street. P. H. Gadsden is president.

ATLANTA, GA.—The city has called a special election on March 25 for the purpose of voting bonds for $75,000 for the installation of an electric generating plant.

JACKSON, GA.—Plans are under consideration by the city for extensive improvements in its electric lighting plant, including the rebuilding of about one and one-half miles of 2300-volt line and the installation of a two-stage electrically-driven centrifugal pump. W. E. Merck is general manager.

SANDERSVILLE, GA.—Plans are under consideration by the city for the reconstruction of its electric-light and water plant recently damaged by fire to the extent of $10,000.

SAVANNAH, GA.—City Council has had preliminary plans prepared for the installation of an electric street lighting system to cost approximately $65,000. L. A. S. Wood, connected with the George S. Cutter Company, South Bend, Ind., is the architect.

SAVANNAH, GA.—The Board of Commissioners of Chatham county granted franchise to Chatham County Traction Company, to build an electric railway from Stiles avenue westward to point on the Bramlett tract, purchased recently by the Foundation Shipbuilding Company, which will establish a shipbuilding plant.

CHRISTIANA, FLA.—Phosphate Mining Company is considering plans for the reconstruction of its power plant recently destroyed by fire. P. H. Fuller, Nichols, Fla., is general manager.

DAYTONA, FLA.—Daytona Public Service Company has filed notice with the Public Service Commission of an increase in its capital from $300,000 to $500,000 to provide for expansion.

WAUCHULA, FLA.—City is planning a bond issue for $25,000 to provide for the installation of an electric lighting system.

NORTH CENTRAL STATES.

COLUMBUS, OHIO.—Officials of Union Gas & Electric Company of Cincinnati have had a conference with the State Utilities Commission relative to an application for higher rates which it is understood will soon be filed by the company. It is said that the company will show a loss of approximately $500,000 for last year due to higher operating costs.

FREMONT, OHIO.—Ohio State Power Company is erecting a large addition to its Ballville plant, increasing its capacity to 24,000 horsepower.

ELWOOD, IND.—The Indiana General Service Company has increased its capital stock from $1,000,000 to $3,500,000.

INDIANAPOLIS, IND.—Letters have been sent out by the Indiana Electric Light Association to its members asking them to protest to Indiana senators and representatives and to Dr. Harry A. Garfield, federal fuel administrator, against the proposed increase of coal prices at the mine after the elimination of the jobbers' margin, which it is proposed is to be borne by the operator receiving the higher mine price.

LAGRANGE, IND.—The Indiana Public Service Commission has issued an order authorizing the Northern Indiana & Southern Michigan Telephone, Telegraph & Cable Company, operating in LaGrange and Steuben counties, Indiana, to charge $2.25 a month for business telephones and $1.75 for residence telephones. The Commission fixed the value of the property of the company at $146,837. The order requires the company to charge off 5 per cent annually for depreciation and permits it to earn 7 per cent on valuation.

RICHMOND, IND.—James P. Dillon, superintendent of the city's electric light and power plant recently made a formal request for the appropriation of $200,000 to increase the equipment of the plant.

ALTON, ILL.—Illinois Public Utilities Commission has made the rates of the Alton Gas & Electric Company for electric window and sign lighting effective March 1, 1918.

AURORA, ILL.—The Illinois Public Utilities Commission has given permission to the Aurora, Elgin & Chicago Railroad to extend for one year from March 1, 1918, the date of payment on $800,000 of notes. Bankers who hold the notes have expressed a willingness to renew them for a period of one year. The notes are secured by a deposit of Aurora, Elgin & Chicago Railroad Company's bonds amounting to $1,067,000. It was shown to the Commission that the company would probably be forced into the hands of a receiver if payment on the notes was demanded March 1, 1918.

AURORA, ILL.—The State Public Utilities Commission has issued an order authorizing the Western United Gas & Electric Company to issue gold bonds to the amount of $232,500. Address Ira C. Copely, president.

HILLSBORO, ILL.—Southern Illinois Light & Power Company has filed a petition with the Illinois Public Utilities Commission asking permission to increase its rates at Enfield, Ill.

LENA, ILL.—The Illinois Public Utilities Commission has permanently suspended the rates for general electric service in Lena, Peral City, Lanark and Shannon filed by the Lena Light and Power Company. The Commission directed the Company to file a new schedule of rates within thirty days to date from March 1, 1918.

MONMOUTH, ILL.—The Illinois Public Utilities Commission has permanently suspended the rate schedule of the Monmouth Public Service Company, proposing an increase of rates for commercial power and electric light service. The company was also authorized to file a new schedule within thirty days.

SPRINGFIELD, ILL.—The Southern Illinois Light & Power Company has filed a petition with the Illinois Public Utilities asking an increase in its electric lighting rates in Donnellson and Palmer, Ill.

SPRINGFIELD, ILL.—The Springfield Gas & Electric Company has filed a petition with the Illinois Public Utilities Commission asking permission to increase the rates for electric power furnished the Springfield Consolidated Railway Company. Both are Hodenpyle-Hardy Company properties but are operated independently.

NEENAH, WIS.—The council will purchase electric equipment for the city stone quarry. Address the city clerk.

LANESBORO, MINN.—The question of issuing $15,000 electric light bonds will be submitted to vote. Address H. T. Asbre, city clerk.

PINE CITY, MINN.—Eastern Power Company contemplates the installation of a 500-kilowatt steam turbine, also developing water power, and a 1000 horsepower ten-mile electric transmission line to connect with its present plant. Address R. P. Allen, manager.

KANSAS CITY, MO.—The Kansas City Light & Power Company has taken out a permit for the erection of its power plant at Front street and Park avenue. The new building will be 244x185 feet in size, four stories high.

MARSHFIELD, MO.—Marshfield Electric Company is planning for extensive improvements and alterations at its plant, to include the installation of new generating unit and the establishment of day service.

ATCHISON, KANS.—Blair Milling Company has awarded a contract to the Missouri Valley Bridge & Iron Company, Leavenworth, Kans., for the construction of a power plant to cost about $40,000.

BUNKER HILL, KANS.—Bunker Hill is considering the erection of a municipal electric light plant.

COLBY, KANS.—Election will probably be held some time in April to vote additional bonds of $10,000 to the $50,000 already authorized, which will be used for lighting and water improvements.

YATES CENTER, KANS.—The city council has passed ordinances submitting the municipal ownership of waterworks, electric light plant and ice plant to vote of the city at the coming election. The vote on each proposition will be separate.

LUSHTON, NEB.—Henry Garb plans the construction of an electric power plant on Blue river to supply electricity in the town of Lushton and to farmers residing along the route of the transmission line.

SOUTH CENTRAL STATES.

KNOXVILLE, TENN.—Tennessee Manganese Company is planning for the construction of an electric furnace for the conversion of ore into ferromanganese, to have a daily capacity of 25 tons.

BIRMINGHAM, ALA.—The new power line in course of construction by the Alabama Power Company from Johns to Bells Sumter is nearing completion and will be ready for service within a few weeks. When the line is completed it will greatly augment the power being furnished the mines at Belle Sumter and make possible a greater output by a quicker haul to the surface.

MUSCLE SHOALS, ALA.—An order authorizing the construction of a large water-power dam in connection with the construction of a large local plant for the Government for the fixation of nitrogen has been signed by President Wilson. The Alabama Power Company has offered to the Government a site for the proposed dam.

BRISTOW, OKLA.—An election to be held March 12 will decide the question of issuing $36,000 electric light plant and improvement bonds.

GARBER, OKLA.—Garber Telephone Co. is erecting a new building.

KINGSTON, OKLA.—The electric light plant recently wrecked by an explosion is to be rebuilt.

LAVERNE, OKLA.—The city has authorized the issuance of $13,000 bonds and will construct an electric light plant. Address the mayor.

PRAGUE, OKLA.—The citizens will vote on the question of issuing $45,000 bonds for electric lights and water plants. Address Ray Parks, mayor.

BRISTOW, OKLA.—City planning for a bond issue for $36,000 for the installation of an electric lighting plant.

DATES AHEAD.

Minnesota Electrical Association. Annual meeting, Hotel Radisson, Minneapolis, March 11-13. Secretary, H. E. Young, Minneapolis General Electric Company.

Wisconsin Electric Association. Annual meeting, Pfister Hotel, Milwaukee, March 27-28, 1918, Secretary, George Allison, 1419 First National Bank Building, Milwaukee, Wis.

Tri-State Water & Light Association. Annual meeting. Charlotte, N. C., April, 1918. Secretary-Treasurer, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical & Gas Association. Annual convention, Galvez Hotel, Galveston, Tex., April 15-16. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

American Association of Engineers. Annual meeting, May 14, 1918. Secretary-Treasurer, A. H. Krom, 29 South La Salle Street, Chicago.

Arkansas Association of Public Utility Operation. Annual convention, Arlington Hotel, Hot Springs, Ark., May 21-22-23. Secretary-Treasurer, R. B. Fowles, Pine Bluff, Ark.

National Electrical Credit Association. Annual meeting, June 1, 1918. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

Texas State Association of Electrical Contractors. Annual meeting. Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Southeastern Section, National Electric Light Association. Annual meeting, June 19-20, 1918. Atlanta, Ga. Secretary-Treasurer, T. W. Peters, Columbus, Ga.

Northwest Electric Light & Power Association; affiliated with N. E. L. A. Annual meeting, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

MIAMI, OKLA.—A bond issue of $45,000 has been authorized by the city to provide for extensions and improvements in its electric lighting system.

STILLWATER, OKLA.—The City Commissioners are considering issuing bonds for $175,000 for extensions in the electric light, power, and water systems.

DALLAS, TEX.—The merged telephone companies here are planning a new exchange. This proposed building will be not less than 18 stories high and thoroughly up-to-date.

SAN ANGELO, TEX.—Interstate Electric Corporation is considering the extension of its electric transmission system to Coleman and Brownwood. The system now embraces San Angelo and Ballinger.

SAN ANGELO, TEX.—San Angelo Ice & Power Company is planning for improvements and alterations in its plant to cost about $10,000.

YOAKUM, TEX.—A contract between the Southwestern Telegraph and Telephone Company and the citizens of Fordtran community has been executed, and the work of constructing the new telephone line will begin at once.

WESTERN STATES.

CHESTER, MONT.—Data are being collected here and at other points relative to the possible power consumption with a view to inducing the Montana Power Company to extend its transmission lines to tap this district.

CASPER, WYO.—Wyoming Electric Company and the Natrona Electric Company have been consolidated under the name of the Natrona Power Company. The new concern is a million-dollar corporation and furnishes electric power and light to the Casper district. Patrick Sullivan is president of the company; E. P. Bacon, vice-president and manager; H. R. Waldo, secretary, and W. L. Biersbach, treasurer.

COLORADO SPRINGS, COLO.—Colorado Springs Light, Heat & Power Company seeks a 10 per cent increase in its rates in residential lighting.

BEAVER CITY, UTAH.—The State Industrial Commission of Utah has ordered the purchase of $2000 of Beaver City electric light bonds, bearing 5½ per cent interest, due in 1937. The purchase is still subject to the action of the state board of examiners.

BELLINGHAM, WASH.—The erection of an electric transmission line to the Cokedale Mine to furnish 500 horsepower to the plant is contemplated by the Puget Sound Traction, Light & Power Company.

CHEHALIS, WASH.—Central Light & Manufacturing Company has filed a petition with the Lewis County Commissioners for a franchise to construct and operate an electric light and power line between Walville, at the Lewis-Pacific county line, to Meskill, 12 miles west of Chehalis.

SEATTLE, WASH.—The lighting department of Seattle has secured a contract for power to be used in the shipyards of the Erickson Engineering Company. This company will construct steel ships and use 2500 horsepower.

SEATTLE, WASH.—Henry M. Landis, state geologist, and Morris M. Leighton engaged by City Engineer A. H. Dimock to make an examination of the Stillaguamish power project offered to the city by John C. Eden, report that it is feasible and that a dam 110 feet high could be constructed. It is expected that an offer will be made on this project March 15.

SEATTLE, WASH. — Northwestern Long Distance Phone Company has asked for a franchise over the county roads of King county hearing before county commissioners set for March 4.

SEATTLE, WASH.—The finance committee of the city council recommends the expenditure of about $6000 to secure information about the Skagit river power site.

SEATTLE, WASH.—City building department will erect the proposed power sub-station for the city lighting department at 14th avenue N. W. and 49th street by day labor instead of letting contract. City Architect Daniel Huntington will supervise the construction. The building will be of reinforced concrete, finished with cement stucco with large spaces of steel sash. Subcontracts will be handled through the office of the city purchasing agent.

TACOMA, WASH.—Proposition to vote $6,500,000 worth of utility bonds for the acquisition by condemnation or stipulation of the entire electric street railway system of the Tacoma Railway & Power Company will be voted on April 2.

VANCOUVER, WASH.—The plant of the United States Signal Corps for cutting spruce has been started here. Construction of the plant was one of the most rapid on record, machinery having been delivered, installed and placed in operation in 58 days. Over 100 Allis-Chalmers motors were used in this plant, also a large amount of sawmill machinery furnished by this company.

INCORPORATIONS

WILMINGTON, DEL.—Natrona Power Company. Capital, $500,000. To generate and distribute electric power, etc. Incorporators: M. M. Clancy, C. L. Rimlinger, and F. A. Armstrong, Wilmington.

BAYONNE, N. J.—Jandous Electric Equipment Company has incorporated for $10,000. B. Freed, L. Freed and G. Silverman of New York City, are the incorporators.

JERSEY CITY, N. J.—Storage Battery Distributing Company. Capital, $6,000. To manufacture storage batteries, etc. Incorporators: John H. Bauer, Howard C. Chase, Jersey City; and Frederick S. Moore, Newark.

NEW YORK, N. Y.—Arma Engineering Company, Inc. Capital, $50,000. To engage as electrical engineers. Incorporators: A. P. Davis, P. C. Werner and D. M. Mahood, 4821 Ft. Hamilton Parkway, Brooklyn.

NEW YORK, N. Y.—Equitable Machinery Corporation has incorporated. Capital, $25,000. To manufacture electrical supplies, etc. Incorporators: C. E. McManus, T. F. Hussa, and C. W. Hussa, Montclair, N. J.

NEW YORK, N. Y.—Hess & Hicks, with a nominal capital of $5,000, have incorporated to engage as electrical and mechanical engineers. Incorporators: J. F. and F. F. Hess and G. Hicks, New York.

NEW YORK, N. Y.—F. D. Schussler Manufacturing Company. Capital, $100,000. To manufacture electrical supplies. Incorporators: F. D. Schussler, T. C. Miller, and T. Moran, 259 Eighty-first Street, Brooklyn.

POUGHKEEPSIE, N. Y.—Dutchess Motor Specialties Corporation. Capital, $50,000. To manufacture motors, engines, etc. Incorporators: A. L., W. H. and S. W. Sherill, Poughkeepsie.

LOUISVILLE, KY.—Rural Light & Power Co. Capital, $6,000, has been incorporated by A. H. Thomson, R. M. Thomson and W. R. Katterjohn.

NEW YORK, N. Y.—Leslie Stevens Company has incorporated with a capital of $10,000 to deal in electrical and general engineering supplies. Incorporators: E. A. Leslie, C. H. Stevens and W. P. Fraendler, 618 Eleventh street, Brooklyn, N. Y.

MONTEREY, IND.—Monterey Light & Power Company has incorporated with a capital of $60,000 to manufacture and distribute electric current. Charles M. Stern, William H. Vandenberg and V. H. Surghnor are directors of the new concern.

ALINE, TEX.—Al-Co Oil, Gas & Electric Company has incorporated for $100,000. Incorporators: L. J. Dixon, L. H. Stephens and I. A. O'Shaughnessy.

CHOTEAU, MONT.—McCullough Electric Company has incorporated with a capital stock of $20,000. H. McCullough, Alice E. McCullough and G. C. Gore are the incorporators.

NEW YORK, N. Y.—A. N. Khouri & Brother, Inc., is a recent incorporation which will manufacture and deal in gas and electric articles. The new concern is capitalized at $3000 and has as its incorporators Marry Sapper, Elie Khouri and Nacle F. Forsely.

GRAFTON, ILL. — Grafton Electric Light & Power Company was recently incorporated with a capitalization of $10,000. William J. Brower, Robert L. Meyensburg, August Miller, D. C. Slaten, John N. Eastmann, E. P. Edsall and P. A. Patton are the incorporators.

PEORIA, ILL.—United States Electrical Supply Company was recently incorporated with a capitalization of $100,000. Walter O. Ireland is president of the new concern, and B. P. Crawley, vice president. The work of the new corporation will be large contract work and the selling of electrical fixtures in wholesale lots.

ATWATER, OHIO.—Atwater Light & Power Company has incorporated; capital stock, $10,000. Incorporators: E. P. Whittlesey, P. W. Whittlesey, C. W. Cummings, Charles Biles and N. W. Brockett.

OTISCO, N. Y.—Otisco Light & Power Company. Capital, $10,000. To operate a plant for the generation and distribution of electricity, etc. Incorporators: M. A. Phelps, E. T. and B. L. Harter, Otisco.

DOVER, DEL.—Electric Steel Company of America has incorporated with a capital of $4,000,000 to manufacture electric steel and kindred products. Incorporators: F. A. Armstrong, M. M. Clancy, and C. L. Rimlinger, Wilmington.

THORPE, WIS.—Thorpe Electric Light & Power Company of Eau Claire has been incorporated. The company will acquire and operate an electric light and power plant at Thorpe. The capital stock is $10,000 and the incorporators are P. D. Kline, Donald Boyd and E. C. Dearth.

GOSHEN, IND.—Service Electric Company has been incorporated with capital of $8000 to buy and sell electrical apparatus. Those interested are Herman A. Schmidt, Harvey Miller and George E. Rohrer.

PROPOSALS

GENERATOR SETS, SWITCHBOARDS, TRANSFORMERS, ETC.—Proposals for generator sets, switchboards, copper cable, and bells, transformers, connectors, terminals, receptacles, copper rod, busbar supports, pipe fillings and floor flanges will be received until 10:30 a. m., March 23, 1918, at the office of the General Purchasing Agent, Panama Canal, Washington, D. C. Blanks and information (Circular 1203) may be received from that office as well as from the assistant purchasing agents at 24 State street, New York City; 606 Common street, New Orleans, La., and Fort Mason, San Francisco, Cal., also from any of the United States engineering offices in the principal cities of the United States. A. L. Flint, general purchasing agent.

PASSENGER ELEVATOR AND COIN LIFTS.—Sealed proposals will be opened in the supervising architect's office, treasury department, Washington, D. C., at 3 p. m., April 3, for the installation of one electric passenger elevator and three electric coin lifts in the United States assay office building, New York, N. Y., in accordance with the drawings and specifications, copies of which may be had in the supervising architect's office.

ELECTRIC WIRING.—The Regents of Education of the State of South Dakota will receive bids March 15 for the installation of the electric wiring in an armory building to be erected at the State College of Agriculture & Mechanic Arts, Brookings, S. D., according to plans and specifications prepared by F. H. Ellerbe, architect, St. Paul, Minn. Address T. W. Dwight, president.

GENERATOR.—Bids will close March 12 for the following additional machinery for the municipal lighting and power plant and waterworks at Sidney, Neb.: one 250-horsepower steam, two 200-horsepower steam boilers, and one 60-cycle, 2300-volt alternating current generator for direct connection to steam engine.

Financial News

War Finance Corporation.

In the annual report of Hon. John Skelton Williams, Comptroller of the Currency, recently submitted, support from the public and Congress in the maintenance of efficiency and credit of public utility companies is strongly urged. He points out that many thousands of investors have suffered seriously from the decline of earning capacity of public utility corporations and consequent shrinkage in the value of their securities, representing investments of many hundred million dollars, which have diminished the power and disposition to respond to calls of the Government for money for war. Mr. Williams states that although these corporations may have deserved and invited hostility in some instances, the attacks made upon them in normal times by the public and press have not been wholly justifiable and reasonable. They have in general served the needs of their communities with reasonable efficiency and have realized fair returns on their investments. He points out that the greatly increased cost of labor and material and other conditions occasioned by the war have had a serious effect upon the public utility companies and is of the opinion that should they be allowed to sink into inefficiency, much of the most important war work of the Government will be crippled or paralyzed. The Comptroller urged that state and municipal authorities exercise forbearance and consideration and that the corporations be permitted to make such additions to their charges for service as will protect their owners against unjust loss and give them a basis of credit on which they may obtain funds with which to meet the strain made upon them.

Narragansett Electric Lighting Report Shows Increase.

Narragansett Electric Lighting Company, Providence, R. I., recently submitted its annual report and statements for the fiscal year ending December 31, 1917. The report states that the total revenue for the past year aggregated $2,566,003.40, an increase of $493,219.04, or 24 per cent over the previous year. Total sales of current amounted to 100,242,080 kilowatt hours, on which an increase of 60 per cent over the output of 1916 was realized. Operating expenses for the year showed an increase of $686,584.49, or 61 per cent, due principally to the large increase in the price of coal. Increases to property and plant totaled $1,106,498.65. Outside of the normal increases made by the company, a high tension transmission line for supplying electricity to Westerly, Mystic, Conn., and adjacent territory a distance of 52 miles from its generating station, was added. A new 60,000 horsepower turbogenerator has been installed at the South street station together with the necessary additions to the building and boiler plant. This unit, soon to be placed in operation, is one of the largest steam engines running in the world. In addition to these, several equally important increases have been made. During the past year its capital stock has been increased to $1,200,000 and $1,700,000 par value new stock has been issued. Appliance and merchandise sales at the electrical shop and branch offices showed a marked increase, gross sales showing a total of $279,760. The booklet, in addition to other information, contains a condensed balance sheet and income account and indicates that despite the unusual and trying conditions of the past year, the business of the company has witnessed a continued growth and extension of operations.

Philadelphia Electric Notes.

A syndicate is being formed by bankers to buy $7,500,000 notes of the Philadelphia Electric Company. The leaders are Harris Trust & Savings Bank, Drexel & Company and Brown Brothers. The company has about $25,000,000 capital stock outstanding, which has paid dividends for 15 years.

Westinghouse Business.

Westinghouse Electric & Manufacturing Company has business already entered on its books of over $130,000,000, not including big machine work for the Government which will be done at the plants of New England Westinghouse Company. Of this total over 60 per cent, or about $80,000,000, represents Government work. The company's surplus for dividends for the year to end March 31, after taxes, will probably amount to between $13,000,000 and $14,000,000, compared with $18,079,889 the preceding year. This earning power is equivalent to between 17½ and 19 per cent on the total $74,812,650 capital stock, against 24.17 per cent last year.

Annual Report of Public Service.

The Public Service Company of Northern Illinois in its annual report shows a gross income for the year ended December 31 last of $8,797,764.64. The net income reached $1,873,564.58. Deducting dividend payments gave a surplus for the year of $585,550.96.

Deducting appropriations for amortization, depreciation, etc., left a final balance carried to surplus of $133,980.16.

The detailed income statement follows:

Gross earnings	$8,797,764.64
Expenses	5,309,333.42
Net earnings	$3,488,431.22
Bond and note interest	1,614,866.64
Net income	$1,873,564.58
Dividends paid on preferred stock	455,280.00
	$1,418,284.58
Dividends paid on common stock	832,733.62
Surplus	$ 585,550.96
Appropriated out of surplus earnings for amortization and depreciation reserve	451,570.80
Balance carried to surplus	$ 133,980.16

The balance sheet for the year shows:

Assets.	
Plants, real estate, etc.	$53,344,502.06
Securities deposited with trustee	227,500.00
Cash deposits with trustees.	5,991.68
Securities	298,915.66
Material in storerooms	816,137.54
Coke, gas, oil, etc., on hand.	152,643.14
Coal in storage	186,337.32
Contract wiring work unbilled	60,872.91
Accounts and notes receivable and municipal warrants	1,207,058.93
Cash	809,700.97
Cash deposit for coupons	44,232.50
Total	$57,213,882.71
Liabilities.	
Preferred stock	$ 7,672,000.00
Common stock	11,951,600.00
Bonds and notes	32,781,000.00
Accounts payable	559,936.03
Notes payable	120,339.08
Customers' deposits	49,230.17
Bond and note interest uncollected	44,232.40
Bond and note interest accrued	469,919.16
Taxes accrued	267,182.34
Amortization and depreciation reserve	2,185,559.30
Balance surplus December 31, 1917	1,112,884.13
Total	$57,213,882.71

In his annual report to stockholders President Samuel Insull says in part:

"In the early part of the year the company issued $5,000,000 of its 6 per cent gold debentures, out of which it paid off on March 1 $3,836,000 of 5 per cent five-year gold coupon notes of the Northwestern Gas Light and Coke Company. During the month of November the company sold $1,500,000 of its 6 per cent collateral gold notes.

"The balance of the proceeds from the sale of the $5,000,000 of debentures, after paying off the $3,836,000 Northwestern Gas Light and Coke Company notes, together with the proceeds of the $1,500,000 collateral gold notes, were used to take care of the company's needed additions to plants and systems. For the coming year it is the policy of the company to make as small an amount of capital expenditure as possible, and such expenditure will be made only where it may be necessary to furnish industrial power for work required by the government and make other extensions deemed absolutely necessary.

"During the year the company has either bought or retired, through sinking funds, $77,100 of its underlying bonds. This makes the aggregate amount of underlying obligations which the company has either retired or deposited with the trustee, under the company's first and refunding mortgage, $7,004,100.

"Approximately 10 per cent of the men in the company's employ have entered the government war service."

Small Investors Own Corporations.

The prevalent opinion held by office holders and politicians generally concerning corporations is far out of accord with the facts. The political orator, whether in legislative halls or in a town meeting, refers to corporations as greedy creatures of Wall street. According to his view, almost anything that is harmful to great corporations will benefit people in general through limiting or decreasing the wealth of multi-millionaires. The war revenue law was framed on this theory. It lays crushing and in some cases confiscatory taxes on corporations.

The idea that these taxes fall principally on people of great wealth is incorrect. The greatest corporations are owned by people of small means. These stocks, instead of gradually becoming concentrated in the Wall street safes, are rapidly being acquired by small investors all over the country.

Kings County Electric Light Directors Re-elected.

At the annual meeting of stockholders of the Kings County Electric Light & Power Company, Brooklyn, N. Y., held February 25, the following were unanimously re-elected directors for the ensuing year: Frank Bailey, Charles A. Boody, J. D. Brady, N. F. Brady, Herbert L. Bridgman, William C. Courtney, Daniel J. Green, Horace C. Duval, Walton Ferguson, Bernard Gallagher, William V. Hester, Adrian T. Kiernan, Thomas E. Murray, James N. Wallace and W. F. Wells. The above named were also re-elected directors of the Edison Electric Illuminating Company at the annual meeting of the company, which was held on the same date.

Los Angeles Gas & Electric Report Shows Increase.

The annual report of the Los Angeles Gas & Electric Corporation recently submitted indicated the gross operating revenue to be the largest in the history of the company, showing an increase of about 4.8 per cent over 1916. Operating and other expenses increased in 1917 in a much greater percentage, the cost of practically every item entering into the manufacture and distribution of gas and electricity having greatly advanced during the year. The net cost of improvements made by the company in the twelve months' period totaled $462,284.58 for the gas department, $207,587.34 for the electric department, and $25,832.36 for general improvements. A depreciation of $773,384.19 was charged off, leaving a net profit for the year of $877,511.76.

Cincinnati Gas & Electric Sells Notes.

The Equitable Trust Company of New York and Weil, Rother & Company have purchased $2,225,000 Cincinnati Gas & Electric Company two-year 6 per cent secured notes, dated March 15, 1918, and due March 15, 1920. The notes are secured by first and refunding, now first mortgage, 40-year 5 per cent bonds, due April 1, 1956. A syndicate will be formed shortly to offer the notes.

Dividends.

Kennecott Copper Corporation has declared a quarterly dividend of $1 a share, payable March 31 to stock of record March 8.

The directors of the Virginia Railway & Power Company have passed the dividend on the common stock. The company paid 3 per cent annually on the issue from April, 1913, to October, 1917, inclusive.

Magma Copper Company has declared a quarterly dividend of 50 cents a share, payable March 30 to stock of record March 8.

Galveston-Houston Electric Company has declared a semi-annual dividend of $3 a share, payable March 15 to stockholders of record March 15.

Niagara Falls Power Company has declared a quarterly dividend of $2 per share, payable April 15 to stockholders of record March 30.

Westinghouse Church Kerr & Company, Inc., declared the regular quarterly dividends of 1½ per cent on the preferred and 1¼ per cent on the common stocks, both payable March 11 to stock of record March 1.

Pennsylvania Water & Power Company declared regular quarterly dividend of 1¼ per cent, payable April 1 to stock of record March 19.

American Public Service Company has declared a quarterly dividend of 1¾ per cent on its preferred stock, payable April 1 to stockholders of record March 22.

West Penn Traction Company has declared a quarterly dividend of 1½ per cent on preferred stock, payable March 15 to stockholders of record March 2.

Consolidated Gas, Electric Light & Power Company of Baltimore, has declared a quarterly dividend of 2 per cent, payable April 1 to stock of record March 15.

Middle West Utilities Company has declared a dividend of 50 cents a share in cash and $1 a share in common stock on its common stock, payable April 1 to stock of record March 15, the cash dividend covering the quarter ended February 15 and the stock dividend covering the half year ended February 15.

Worthington Pump & Machinery Corporation has declared a quarterly dividend of 1¾ per cent on its preferred A stock and 1½ per cent on its preferred B stock, both payable April 1 to stock of record March 20.

Montana Power Company has declared a quarterly dividend on its common stock of 1¼ per cent and 1¾ per cent on its preferred stock, both payable April 10 to stock of record March 12.

The Board of Directors of the Oklahoma Gas & Electric Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock of the company, payable March 15 to stockholders of record February 28.

The Board of Directors of the Standard Gas & Electric Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock of the company, payable March 15 to stockholders of record February 28.

The Board of Directors of the Muskogee Gas & Electric Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock of the company, payable March 15 to stockholders of record February 28.

A dividend of $2 per share has been declared by the General Electric Company, payable April 15 to stockholders of record March 9.

Earnings.

SOUTHWESTERN POWER & LIGHT COMPANY.

(Subsidiary companies.)

	1917.	1916.
December gross	$ 457,417	$ 407,857
Net earnings	179,918	185,273
12 months' gross	4,677,378	4,193,265
Net earnings	2,064,070	2,021,446

CONSUMERS POWER COMPANY.

For the 12 months ending December 31, the gross earnings of the Consumers Power Company, Jackson, Mich., totaled $5,775,371, an increase over 1916 of $1,028,170; net profit after taxes amounted to $2,393,114, or a decrease of $134,917. The surplus of the company after charges were paid was $1,451,222, a decrease of $178,821, and a balance after payment of preferred dividends of $883,449, showing a decrease of $282,814.

NORTHERN OHIO ELECTRIC CORPORATION.

The earning statement of the Northern Ohio Electric Corporation for December shows an increase of 19.79 per cent in the gross earnings, 26.47 per cent in the operating expenses and 11.32 per cent in the net earnings. The balance above dividend requirements shows a decrease of 10.96 per cent. For the months ending with December the gross earnings were 23.66 per cent greater than for the preceding year and the operating expenses were 47.99 per cent greater. The balance shows a shrinkage of 24.08 per cent and is now equivalent to $7.49 per share.

AURORA, ELGIN & CHICAGO.

Income account for the year ended December 31:

	1917.	1916.
Total earnings	$2,181,871	$2,056,362
Net after taxes	606,099	675,494
Balance after interest	177,583	241,583
Balance after depreciation	98,277	172,583
For December—		
Total earnings	186,094	176,571
Net after taxes	44,624	53,318
Interest	35,624	35,855
Balance	9,000	17,463
Res., depreciation and amortization	6,698	6,496
Balance	2,302	10,967

CITIES SERVICE COMPANY.

For January—	1918.
Gross	$ 2,031,462
Net after taxes	2,000,491
Surplus after charges	2,000,286
For the twelve months ended January 31—	
Gross	19,429,506
Net after taxes	19,063,034
Surplus after charges	19,060,264

National Transit Company.

The balance sheet of the National Transit Company, as of December 31, 1917, compares as follows:

Assets.

	1917.	1916.	1915.	1914.
Plant	$ 8,137,442	$ 8,160,823	$ 6,384,117	$ 6,867,834
Mchd. tank's	.....	.....	74,925	826,387
Other inventory	4,404,802	3,590,135	8,125,654	6,619,396
Cash	523,404	333,852	534,280	715,690
Accounts receivable	174,225	976,378	594,088	416,328
Def'd assets	38,363	37,359	.....	.....
Unadjusted debits	178,776	13,330	.....	.....
Total	$13,457,012	$13,111,877	$15,713,064	$15,445,635

Liabilities.

Capital stock	$ 6,362,500	$ 6,362,500	$12,727,575	$12,727,575
Curtailment liability	336,371	730,225	315,285	309,468
Unadjusted credits	449,891	446,745	255,187	.....
Depreciation	2,630,057	2,203,109	.....	.....
Surplus	3,678,193	3,369,298	2,415,017	2,408,592
Total	$13,457,012	$13,111,877	$15,713,064	$15,445,635

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Feb. 26.	Bid. Mar. 5.
Adirondack Electric Power of Glens Falls, common	6	15½	15½
Adirondack Electric Power of Glens Falls, preferred	6	72½	72½
American Gas & Electric of New York, common	10 +extra	88	88½
American Gas & Electric of New York, preferred	6	40	39¾
American Light & Traction of New York, common	..	222	209
American Light & Traction of New York, preferred	6	95	95½
American Power & Light of New York, common	4	43	47
American Power & Light of New York, preferred	6	73	73
American Public Utilities of Grand Rapids, common	..	20	20
American Public Utilities of Grand Rapids, preferred	6	54	54
American Telephone & Telegraph of New York	..	106⅛	107
American Water Works & Elec. of New York, common	..	4¾	4¾
American Water Works & Elec. of New York, particip	7	10	12
American Water Works & Elec. of New York, first preferred	..	59	57
Appalachian Power of Bluefield, common	..	2¼	2¼
Appalachian Power of Bluefield, preferred	7	20	20
Cities Service of New York, common	+extra	203	200
Cities Service of New York, preferred	6	74¾	74½
Commonwealth Edison of Chicago	8	106½	107
Comm. Power, Railway & Light of Jackson, common	..	21½	22½
Comm. Power, Railway & Light of Jackson, preferred	6	50	50
Federal Light & Traction of New York, common	..	5	5
Federal Light & Traction of New York, preferred	..	28	27
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	27
Middle West Utilities of Chicago, preferred	6	59	58½
Northern States Power of Chicago, common	ex.div.7	60	61
Northern States Power of Chicago, preferred	ex.div.7	86½	86½
Pacific Gas & Electric of San Francisco, common	..	32	37
Pacific Gas & Electric of San Francisco, preferred	6	81	82½
Public Service of Northern Illinois, Chicago, common	7	75½	75
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	23¾	22½
Republic Railway & Light of Youngstown, preferred	6	56	57
Standard Gas & Electric of Chicago, common	..	6	6
Standard Gas & Electric of Chicago, preferred	6	24	24
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	8	8
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	60½	60½
Western Power of San Francisco, common	..	11	12
Western Power of San Francisco, preferred	6	46	48
Western Union Telegraph of New York	extra	89½	89
Industrials—			
Electric Storage of Philadelphia, common	4	49⅞	49
General Electric of Schenectady	8	137½	140¾
National Carbon of Cleveland, common	8	56⅛	56⅛
National Carbon of Cleveland, preferred	..	130¾	130¾
Westinghouse Electric & Mfg. of Pittsburgh, common	+extra	41¾	42
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	63

*Last sale.